

NAVAL POSTGRADUATE SCHOOL MONTEREY, CALIFORNIA



THESIS

AN ANALYSIS OF THE SEPARATION BONUS (VSI/SSB) PROGRAM USING THE ANNUALIZED COST OF LEAVING MODEL

by

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March, 1996

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**AN ANALYSIS OF THE SEPARATION BONUS (VSI/SSB) PROGRAM
USING THE ANNUALIZED COST OF LEAVING MODEL**

Frank Rogge
Lieutenant Commander, German Navy

Submitted in partial fulfillment
of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

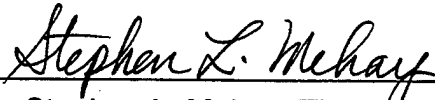
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ABSTRACT

This thesis investigates the effect of the Voluntary Separation Incentive/ Special Separation Bonus (VSI/SSB) on the voluntary separation behavior of Navy officers and Navy enlisted personnel using the Annualized Cost of Leaving (ACOL) model. The thesis also estimates the effect of the threat of a reduction-in-force (RIF) on VSI/SSB program acceptance behavior. Data provided by the Defense Data Manpower Center (DMDC) on VSI/SSB eligible Navy officers and Navy and Air Force enlisted personnel in FY93 and FY92 are used for the empirical analyses. Multivariate probit models are estimated to predict the voluntary separation rate in the absence of the financial incentive. These estimates are used to calculate the costs and benefits of the VSI/SSB program for both Navy officers and Navy enlisted personnel. This thesis finds that the VSI/SSB program increased the voluntary separation rate by 44.93 percent for Navy officers, but only by 4.29 percent for Navy enlisted personnel. The threat of RIF significantly increases voluntary separation rates.

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I. INTRODUCTION

A. BACKGROUND

With the global political changes in the late 1980's leading to a reduction in perceived external security threats and the federal government increasingly placing emphasis on reducing the federal deficit, the U.S. military services experienced substantial cuts in their budget authorities for the first time since the advent of the All-Volunteer-Force (AVF). Simultaneously, the cessation of the communist threat brought an end to the military's reliance on containment policies, thus diminishing the need for a large standing army (Warner and Pleeter, 1995). Thus, in the late 1980's/early 1990's, finding it increasingly difficult to justify its military strength and facing decreasing funding, the Department of Defense (DoD) was forced to reduce its size. For any organization in this particular situation the biggest and fastest savings are achieved through personnel reductions. Between 1989 and 1995 cutbacks were planned to encompass approximately 500,000 servicemen and women throughout DoD. Reducing active duty personnel by this amount would save the Defense Department \$103.2 billion over the next five years, as compared to, for example, savings of only \$2.1 billion during the same time period if the Navy chose to decommission its four Iowa-class battleships. (Kirby, 1993)

Because of its unique internal labor market, attempts to reduce its numbers and simultaneously maintain an effective, motivated and well-trained force, pose particular challenges for DoD. Reducing the number of accessions

is one possibility to cut down personnel, but trying to accomplish a drawdown of this size solely by decreasing the level of recruitment would inevitably lead to severe shortages in higher paygrades and in certain military occupational specialties (MOS) later. Due to its internal labor market, DoD is forced to enlist a certain amount of young men and women each year to ensure that a sufficient pool of junior personnel is available to become the senior personnel of the future. The flow of accessions needed is based on force size and structure. However, a lower force size allowed a proportionate reduction in the flow of new recruits. Thus the Navy lowered its accessions between FY 1990 and FY 1994 by 29 percent. (Giarrizzo, 1993)

Solving the problem of manpower reductions entirely by introducing mandatory early retirement policies also would have distorted the shape of the force, only that then the military services would have faced a shortage in senior, experienced personnel that probably would have negatively affected military effectiveness.

Another alternative policy to reduce personnel would be involuntary separations or reductions-in-force (RIF), but the potential costs associated with such a policy would be immense. Historically, military personnel have come to believe that once they gain six or eight years of service (YOS), DoD virtually guarantees them to serve to at least 20 years and thus become vested for retirement benefits if they meet certain performance standards. Using RIF would have broken this "implicit contract" between DoD and career personnel and thus

would have severely damaged morale and motivation of the remaining personnel. Potentially being interpreted as "opportunistic" behavior on the part of DoD, a RIF may have caused a loss of reputation as an employer which additionally may have created future retention and recruitment problems. (Mehay and Hogan, 1995) Additionally, the impact of a major RIF by the largest employer in the U.S. on politics and society was of substantial concern to policy-makers and therefore, it was congressionally-directed that involuntary separations of career members should be avoided altogether if possible.

Thus, accomplishing the largest personnel drawdown in the history of the AVF but at the same time maintaining a balanced force structure required the Department of Defense to introduce new policies to induce non-vested mid-career personnel to leave voluntarily. To reshape the force so that personnel inventories and quality levels match the requirements of the new smaller force structure, Congress authorized the Voluntary Separation Incentive/Special Separation Bonus (VSI/SSB) program in the National Defense Authorization Act for FY92. This program was intended to target specific paygrade grades, ratings and YOS cells to ensure that the drawdown would be accomplished without personnel and skill shortages in each cell.¹ The program offered two different financial separation incentives that are briefly described below.

¹ For a detailed description of the VSI/SSB program refer to: Kirby, Mary A., "A MULTIVARIATE ANALYSIS OF THE EFFECTS OF THE VSI/SSB SEPARATION PROGRAM ON NAVY ENLISTED PERSONNEL", Master's Thesis, Naval Postgraduate School Monterey, CA, March 1993.

B. THE VOLUNTARY SEPARATION INCENTIVE (VSI) AND SPECIAL SEPARATION BONUS (SSB) PROGRAMS

The Secretary of Defense might offer service members the opportunity to apply for an early separation bonus provided they meet following eligibility criteria:

1. He/she must have served on active duty for a minimum of six years before December, 5 1991 and must have completed his/her initial term of enlistment or initial period of obligated service;
2. He/she must have served at least five years of continuous active duty prior to the date of separation;
3. Upon separation he/she must have served less than 20 years of active duty service and must not be eligible for retired or retainer pay;
4. He/she must meet certain other criteria as the secretary of their respective service may prescribe, i.e., additional requirements regarding years of service, paygrade, skill or rating, and remaining period of obligated service. (Kirby, 1993)

If eligible, service members may apply to leave active duty and, once approved for separation by the Secretary of Defense, may choose to be compensated by either the VSI or the SSB program. Those who choose to separate and take the VSI receive an annual payment starting at the date of their departure from active duty, where the total number of annual payments equals twice the number of years of active duty. The annual payment is computed by the following formula:

$$\text{Annual VSI payment} = 2.5\% * \text{final month's basic pay} * 12 * \text{YOS}$$

Those who choose to leave and take advantage of the lump sum payment receive a one time financial payment calculated as follows:

$$SSB\ amount = 15\% * final\ month's\ basic\ pay * 12 * YOS$$

DoD introduced these policies January 1, 1992 in the hope they would allow accessions to remain at sustaining levels and that targeting the right number of persons at the right time would ensure sufficient promotion opportunities for the new, smaller career force. (Mehay and Hogan, 1995) Although created by DoD for all four services, the implementation of the program varied by service. The Navy explicitly renounced the possibility of reductions-in-force in the event the acceptance of the voluntary separation program lagged behind expectations. Air Force members, however, from the beginning of the drawdown faced the threat of involuntary separation. Although VSI/SSB was implemented, the USAF conditioned RIF on whether the acceptance of the program met their reduced end strength goals. As a measure of vulnerability to a RIF the Air Force introduced a five-tier system with tier 1 being exempt from being separated involuntarily and tier 5 having the highest threat of a RIF. (Sewell, 1994) Tables 1.1 and 1.2 show the number of people who accepted VSI/SSB for all four services during fiscal years 1992 through 1995 for officers and enlisted personnel, respectively.

Table 1.1 VSI/SSB Acceptance Figures for Officers

		FY 92	FY 93	FY 94	FY 95
Navy	VSI	0	258	392	28
	SSB	0	432	633	40
Army	VSI	2064	1180	608	0
	SSB	2696	1267	754	1
USAF	VSI	1109	1598	95	0
	SSB	1233	1123	47	0
Marine Corps	VSI	10	149	133	0
	SSB	1	119	66	0
Department of Defense	VSI	3165	3185	1228	28
	SSB	3930	2941	1500	41
	total	4295	6126	2728	69

Source: derived from data obtained from Defense Manpower Data Center (DMDC)

Table 1.2 VSI/SSB Acceptance Figures for Enlisted Personnel

		FY 92	FY 93	FY 94	FY 95
Navy	VSI	622	292	567	20
	SSB	3501	3103	2671	110
Army	VSI	1685	122	217	0
	SSB	23469	3415	5265	25
USAF	VSI	1150	1181	138	0
	SSB	13673	7494	530	0
Marine Corps	VSI	146	311	174	0
	SSB	730	1037	380	0
Department of Defense	VSI	3603	1906	1096	20
	SSB	41373	15049	8846	135
	total	44976	16955	9942	155

Source: derived from data obtained from DMDC

It is interesting to note that for enlisted personnel the take rate of the SSB option exceeds by far that of the VSI throughout all four services. The figures for the officers, however, reveal that with the exception of the Navy, the VSI and the SSB acceptance figures are more equally split and that officers in the Marine Corps by far preferred the VSI over the SSB option of the program.

C. PURPOSE OF THESIS

A substantial amount of research has already focused on identifying the factors that affect the voluntary separation decision and those that influence the choice between the two programs. It has been consistently found that individual characteristics significantly affect both decisions. However, so far few studies have attempted to estimate the underlying true voluntary separation rate, i.e., who was really induced by the financial incentives to leave active military duty? As with most financial incentive policies, a major disadvantage of VSI/SSB is providing payments to those who would have left anyway even without the incentive program. To minimize this economic rent, policy makers must be able to estimate the separation rate without financial inducements; that is, how many of those personnel who were at a reenlistment point would have left without the financial incentive? Furthermore, how many who were still obligated would have left without the incentive if they had simply been released from their contract? Additionally, with increasingly scarce resources available for the military even a politically acceptable program such as the VSI/SSB must constantly be reevaluated to determine whether benefits outweigh costs and whether it is an efficient program.

This thesis statistically estimates the true separation rates of naval officers during FY93 and of Navy enlisted personnel during FY92 using the Annualized Cost of Leaving (ACOL) framework. These were the first years of the program for each group. Applying the same model, it then compares Navy

with Air Force enlisted personnel to determine whether the threat of involuntary reductions-in-force significantly influenced the separation decision during FY92. The hope is that the information developed here can help military policy makers to design efficient programs to accomplish future reductions in personnel. Knowing the costs and the true benefits of VSI/SSB, the mix of various programs implemented to decrease the size of the military forces (from reducing accessions to early retirement) can be optimized to implement the most effective drawdown.

The remainder of the thesis is divided into four chapters. Chapter II presents the analytic framework of the ACOL model and reviews relevant literature. Since previous research dealt with literature relevant to the theory of personnel reduction, Chapter II focuses on whether the ACOL model is suitable to analyze separation behavior, explains the underlying theoretical approach and reviews the relevant ACOL literature. Chapter III explains the applied methodology and describes the data used in this thesis. The computations for the various variables are introduced and important assumptions are discussed. Chapter IV presents the results of the models and estimates the true effect of the VSI/SSB program as well as the effect of the threat of a RIF on the separation decision. Chapter V summarizes the results of the research.

D. RESEARCH QUESTIONS

The primary concern of this thesis is to statistically estimate the underlying true separation rate of VSI/SSB eligible personnel. Other issues include:

1. Can the ACOL framework, which initially was developed to analyze the military reenlistment decision, be applied to the separation decision of VSI/SSB eligible personnel?
2. What are the immediate financial costs of the VSI/SSB program and what are its benefits?
3. Is the threat of involuntary separation an effective complement to the VSI/SSB program, i.e., did it significantly increase the acceptance rate of comparable personnel?

II. LITERATURE REVIEW

A. ANNUALIZED COST OF LEAVING FRAMEWORK

With the advent of the All-Volunteer-Force (AVF) in 1973 and the associated change of personnel supply, the Department of Defense (DoD) placed increasing emphasis on analyzing and understanding the reenlistment behavior of enlisted personnel. It is in this context that the Annualized Cost of Leaving model (ACOL) was originally developed. Warner and Goldberg (1984) used the ACOL model to explain the effect of monetary and non-pecuniary factors on enlisted retention. To make the retention decision, the individual is assumed to compare the utility from leaving immediately with the utility of remaining over each possible future period n of military service, where $n=1,2,\dots,s$ and s denotes the maximum allowable future periods of service. They assumed that depending upon rank, all personnel are mandatorily retired at various points between 20 and 30 years of service. The utility associated with each outcome (staying vs. leaving) is the sum of two components: the present value of the income stream of the outcome and the present value of the monetary equivalent of the non-pecuniary aspects of the outcome. The latter component is unobserved. Their model used the following definitions:

M_j = the individual's expected military pay in each future year of service,
 $j = 1,\dots,s$

R_{jn} = yearly retired pay the individual will receive after n more years of service, $j = n+1,\dots,T$, where T equals life expectancy.

W_{j0} = the future civilian earnings stream the individual expects to receive
if he leaves immediately, $j = 1, \dots, T$

W_{jn} = the future civilian earnings stream the individual expects to receive
if he leaves after n more periods, $j = n+1, \dots, T$

ρ = the individual's yearly discount rate

They denoted γ_m and γ_c as the annual monetary equivalents of the non-pecuniary aspects of military and civilian life, respectively. Warner and Goldberg assumed these values to be fixed over time for a given individual, but to be jointly normally distributed with means (μ_m, μ_c) and variances (σ_m^2, σ_c^2) across individuals.

The individual's retention decision is assumed to be based on utility maximization. The utility of remaining in the military exceeds the utility from leaving immediately only if the present value of military pay plus the taste factor for military life over the n year reenlistment period, plus the present value of retirement pay and post-military civilian pay and the taste factor for civilian life over the remaining years of life, is greater than the present value of the sum of civilian pay and the taste factor for civilian life if the individual leaves immediately. This condition can be written as:

$$\sum_{j=1}^n \frac{M_j + \gamma_m}{(1+\rho)^j} + \sum_{j=n+1}^T \frac{R_{jn} + W_{jn} + \gamma_c}{(1+\rho)^j} > \sum_{j=1}^T \frac{W_{j0} + \gamma_c}{(1+\rho)^j} \quad (1)$$

Or, alternatively, this condition for staying in the military can also be written as:

$$C_n = \sum_{j=1}^n \frac{M_j}{(1+\rho)^j} + \sum_{j=n+1}^T \frac{R_{jn} + W_{jn}}{(1+\rho)^j} - \sum_{j=1}^T \frac{W_{j0}}{(1+\rho)^j} > (\gamma_c - \gamma_m) \sum_{j=1}^n \frac{1}{(1+\rho)^j} \quad (2)$$

or in abbreviated form:

$$C_n > \delta \sum_{j=1}^n \frac{1}{(1+\rho)^j} \quad (3)$$

where C_n is the cost of leaving and δ is the net preference for civilian life over military life ($\gamma_c - \gamma_m$). Finally, dividing both sides by $\sum_{j=1}^n \frac{1}{(1+\rho)^j}$ they express the condition for remaining in the military as:

$$A_n = \frac{C_n}{\sum_{j=1}^n \frac{1}{(1+\rho)^j}} > \delta \quad (4)$$

with A_n as the Annualized Cost of Leaving over the horizon of n years of reenlistment.

According to this model the individual prefers a strategy of staying n more years in the military to one of leaving immediately only if the annualized cost of

leaving exceeds the net taste for civilian life, where it is assumed that $\delta > 0$. The individual will leave only if the strategy of leaving immediately is preferred to any strategy that involves staying, or $A_n < \delta$ for all $n = 1, \dots, s$. This is equivalent to the condition $\max A_n < \delta$ so that the relevant ACOL value for the retention decision is the maximum over the set (A_1, \dots, A_s) and the relevant time horizon for the retention decision is the one over which the ACOL value is maximized. Assuming that the net tastes for civilian life are distributed normally $N(\mu, \sigma^2)$ with mean μ and variance σ^2 the previously mentioned decision rule to stay can be written as:

$$r_i = P(ACOL_i^* > \delta_i) = \int_{-\infty}^{\frac{ACOL_i^* - \mu}{\sigma}} N(0,1) dz \quad (5)$$

or as:

$$r_i = P(ACOL_i^* > \delta_i) = \int_{-\infty}^{\beta_0 + \beta_1 * ACOL_i^* + \lambda_i * \underline{X}_i} N(0,1) dz \quad (6)$$

where r_i represents the probability of staying for individual i , $ACOL_i^*$ is the maximum ACOL value for individual i , and λ_i and \underline{X}_i are the respective vectors of parameters and individual characteristics.

Warner and Goldberg calculated the expected military pay plus retirement pay stream by using a recursive dynamic programming algorithm with imbedded promotion probabilities dimensioned by paygrade and length of service (LOS) for

which the authors employed average Navy promotion rates. Estimates for the civilian earnings stream were derived by estimating an earnings function with linear and quadratic terms for years of post-military experience and various demographic variables. Their calculations of A_n over different time horizons revealed that for most service members at their first-term reenlistment point the maximum A_n is found over the horizon of a 4-year reenlistment. Only when personal discount rates were 10 percent or lower and no reenlistment bonus was paid was the optimal horizon as long as 20 years of service.

Using this framework, Warner and Goldberg concluded that ACOL explains much of the variation in the probability of reenlisting. They estimated probit models for several Navy enlisted occupational groups and found that ACOL and being married both affected the retention decision positively and were statistically significant. The estimated probit coefficient of ACOL was in the range 0.000121 to 0.000325. Because their ACOL variable already took in account pay differences attributed to marital status, the rise in reenlistment rates due to marital status is speculated to reflect the greater value of non-pecuniary benefits, such as health care for dependents, available to married personnel.

Subsequent research on the decision to stay in the military reemphasizes the importance of the economic factors modeled in ACOL. Smith et al (1991) estimated econometric models of first- and second-term reenlistment decisions of Army enlisted personnel. To control for self-selection as members progress through the personnel system, they used a slightly different version of the

original ACOL model, the ACOL2 model. Using age-earnings profiles to estimate the civilian pay stream until age 65 and promotion time models to derive the future military pay stream, the authors calculated that for almost all the enlisted soldiers in their sample the maximum ACOL at both the first- and second-term decision points involves a military career that lasts through 20 years of service. The maximum value of ACOL was found to be prior to becoming eligible for retirement because, due to the vesting of the military pension after completing 20 YOS, ACOL values for military careers longer than 20 years are less than at the 20-year point.

Further developing the Warner and Goldberg (1984) model specification, Smith et al concluded that the ACOL variable, being a member of a minority group and being female all increase the probability of reenlisting. On the other hand, the AFQT score (as a measure of the individual's ability) lowers it significantly in 2 out of 6 regressions and increases it (but insignificantly) in the remaining 4. Consistent with Warner and Goldberg's findings, they found that the number of dependents (as a proxy for the individual's preference for the non-pecuniary benefits of military life) affected retention behavior positively. The weak and inconsistent effect of the AFQT scores on the stay/leave decision is not unexpected because some studies have found that higher quality personnel are associated with higher reenlistment probabilities (Daula and Baldwin, 1986), while other studies have found a negative relationship between AFQT and reenlistment rates (Black et al, 1987).

In a similar analysis of first- and second-term reenlistment decisions, Daula and Moffitt (1995) compared the ACOL model to dynamic programming models and found that all give approximately the same fit. Their results basically duplicate those of Smith et al (1991) with regard to race, AFQT and dependents. Additionally, it was found that enlistees who enlisted to obtain educational benefits were less likely to reenlist. Those who were induced to enlist by those programs are hypothesized to take advantage of them as early as possible and, thus, have an incentive to leave at their first reenlistment point.

In one of the few studies that dealt with the retention behavior of officers, Mairs et al (1992) estimated a two-decision ACOL2 retention model of Air Defense Artillery (ADA) officer personnel. Specifying 2 three-year decision windows, they used a panel probit regression procedure and found statistical evidence that the ACOL significantly affects retention positively. They found the ACOL coefficient to be 0.000021. Using dummy variables for marital status, gender and race in their regression equation to control for differences in the civilian income stream and for differences in the preferences for military life, the authors concluded that married and female personnel are more likely to stay, while ethnic minorities are less likely to stay. This duplicates Smith et al's (1991) findings on sex and marital status but contradicts those on race. However, it is important to realize that this study analyzed the first- and second-term reenlistment behavior of enlisted personnel whereas Mairs et al (1992)

studied the retention decision of officers upon completion of their initial obligated service, i.e., personnel not forced to fulfill an enlistment contract.

In a study on the separation behavior of not-contract bound workers, Black et al (1990) focused on the dynamics of job separation of Federal civilian employees of the DoD. Instead of computing the Annualized Cost of Leaving the authors calculated the "Annualized Cost of Staying" and concluded that increases in Federal compensation significantly improve retention of employees, that females are more likely to quit than males and that blacks are less likely to voluntarily leave their jobs than whites.

Although most of the previously mentioned research focused on the reenlistment behavior of relatively junior personnel, Goldberg (1982) analyzed the effect of military pay on the retention rates of third-term enlisted personnel in the U.S. Navy. Using data on all third-termers (length of service 11-14) who were eligible to make reenlistment decisions, Goldberg assumed the individual either reenlisted and stayed until YOS 20 or left the Navy immediately. Historically, reenlistment rates approach unity with increasing length of service, because mid-careerists who stay in for 11 to 14 years have strong preferences for military life. This self-selection, combined with a rising attractiveness of the military retirement system with increasing YOS, is hypothesized to be a major factor in influencing reenlistment behavior. Thus, Goldberg chose a relevant horizon from the date of the reenlistment decision to the date at which the individual could retire from the Navy to calculate the military pay stream.

Assuming that those who stay for 20 will earn the same as those veterans who left earlier, Goldberg used the same time horizon for computing the returns of leaving the Navy at the decision point. Specifying logit regression models for 9 different occupational groups with ACOL being the only explanatory variable, Goldberg found that all coefficients were significant and varied from 0.000179 to 0.000280.

The variety of problems analyzed using the ACOL approach illustrates the broad range of possible applications for this framework. Statistical evidence emphasizes the influence of the annualized cost of leaving on reenlistment, retention and voluntary separation behavior while the effects of demographics such as gender and race are inconsistent. Currently, the ACOL model is one of the most popular estimation techniques for analyzing personnel dynamics in DoD, but a major issue still to be discussed is whether it is an appropriate means to model the separation behavior of VSI/SSB eligible personnel.

Sherman (1993) specifically analyzed this particular issue by examining soldiers' responses to a survey on a proposed VSI/SSB program and, using the framework of occupational decision making, he identified factors affecting soldiers' decisions about separating. According to his study,

The reenlistment decision is essentially a comparison of current and future earnings and satisfaction in the military in comparison to the same outcomes if one were to leave the military.

It seems reasonable that the decision making process and factors that underlie the decision to accept or reject an early separation incentive are very similar to those that affect the reenlistment decision and that the "Reenlistment Models" can be directly applied to the analysis of the early separation incentive decision.

Making use of data from the Survey of Total Army Military Personnel (STAMP), which was mailed to 51,000 active and reserve soldiers shortly after Operation Desert Shield/Storm, Sherman assessed soldiers' responses to separation incentives and their reactions to variables commonly used in the ACOL model. Note that only soldiers with between 6 and 19 years of service answered the items on the early separation incentive offers. This YOS cell roughly corresponds to the actual VSI/SSB eligibility range. To evaluate alternative Army reenlistment models the author examined the correlation between ACOL variables and separation incentives and came to the following conclusions:

1. Army reenlistment models provide a sound explanatory basis for understanding early separation incentive decision making,
2. Years of service and rank have been shown to be significantly related to early separation behavior,
3. Race and gender do not statistically significantly affect the early separation incentive decision.

Sherman's findings support the hypothesis that the ACOL framework is a viable method to analyze separation behavior in conjunction with the offering of financial separation incentives.

B. THE PERSONAL DISCOUNT RATE

An important factor in the ACOL framework is the personal discount rate (PDR). It is critical in the calculation of the present values of both the returns of staying in and leaving the military and in annualizing the difference of the two pay streams. The higher the individual's PDR, the greater he/she discounts earnings received further in the future, for example retirement benefits. Since military retirement is regarded as a significant factor in bringing the lifetime earnings of military personnel up to parity with their civilian counterparts, cuts in pension benefits could severely reduce the attractiveness of the military as a career. Thus, to better estimate the effects of changes in the retirement system on personnel dynamics, a multitude of studies have addressed the question of the personal discount rate of officers as well as enlisted personnel. However, past research on the PDR is instructive but far from conclusive.

Nord and Schmitz (1985) in their study to assess the PDR reviewed a wide variety of previous research and tried to combine the results to come up with more consistent estimates before conducting their own analysis. Table 2.1 presents an overview of their findings on the personal discount rate. As shown in Table 2.1, estimates of the personal discount rate vary in the relatively wide range from 1.2 to 39 percent, but generally decline with age.

Table 2.1 Results of Selected Studies on the Personal Discount Rate (PDR)

Study	Sample Group	PDR (%)
Friedman (1957)	U.S. farm families ^a	30
Landsberger (1971)	Israeli consumers ^a	9-27
Heckman (1976)	U.S. consumers ^a	18-20
Rosen (1976)	U.S. male high school and college graduates ^a	7.2-8.7
Hausman (1979)	46 U.S. households and its persons ^a	10-39
Leffler and Lindsay (1981)	Applicants to medical school ^a	10
Gilman (1976)	Civilian employees	1.2-24
Cylke et al (1982)	Navy enlisted personnel ^a	16-20
Black (1983)	Enlisted personnel of all services ^a	12.5

^a information about the sample group were obtained from the respective study. See reference section for source description.

Source: Nord and Schmitz (1985)

To derive their own results, Nord and Schmitz chose to conduct a direct assessment study, i.e., a method that uses survey data to arrive at PDR estimates. Using the existing 1983 Army Research Institute (ARI) Exit Survey and attaching a set of questions to it, the survey was administered to 6,498 soldiers in grades E-3 to E-9 undergoing processing prior to a permanent change of station or exit from the Army. Their findings suggest the PDR for the

average soldier in their sample to be 14.2 percent, which reemphasizes those studies that found it to be in the range of 10 to 20 percent.

Analyzing the decision of military personnel to choose between the lump-sum payment or the annual installment version of the VSI/SSB program Warner and Pleeter (1995) estimated personal discount rates of officers and enlisted personnel in FY92 and FY93. Reviewing previous research on PDRs, the authors drew three general conclusions:

1. Individuals do not discount all future values at the same rate; the PDR appears to decline for choices involving larger sums.
2. The personal discount rate varies with the time delay of the reward or penalty. Individuals appear to discount future amounts hyperbolically, applying higher discount rates to amounts with a short delay.
3. There is some evidence that the PDR varies with personal characteristics. It has been found to decline with education, age, and income while being a member of a minority seems to increase the discount rate. However, results with respect to gender and marital status were mixed.

For each individual in their sample Warner and Pleeter calculated the break-even discount rate D^* , i.e., the rate that equates the value of the SSB lump-sum with the present value of the VSI annuity. Individuals are expected to choose the SSB over the VSI if their personal discount rate D exceeds D^* and to select the VSI if otherwise.

To model the VSI/SSB choice formally, they expressed D as a linear function of the vector of observed characteristics (\underline{X}) of individual i and random error (ε):

$$D = \beta * \underline{X} + \varepsilon \quad (7)$$

Assuming that $\varepsilon \sim N(0, \sigma^2)$ and that individuals select the lump-sum SSB payment if $D > D^*$, the personal discount rate was estimated by using probit regression equations. It was found to be 18.5 percent for the average officer and to be at least 23 percent for the average enlisted person. However, according to Warner and Pleeter the enlisted predictions in excess of 23 percent are implausibly high.

C. THE TRUE EFFECT OF THE VSI/SSB PROGRAM

At least one study tried to determine the true effect of the VSI/SSB program on separation behavior. Mehay and Hogan (1995) analyzed the factors affecting the voluntary separation behavior of Navy enlisted personnel in FY92. Specifying logit regression models of the decision to either accept the VSI/SSB program and leave the military forces or to reject it and stay in, Mehay and Hogan found that those with higher paygrade grade and more military experience (higher YOS) were less likely to accept the bonus. These results suggest that, on balance, these factors increase military pay (by increasing the probability of and size of the pension benefit) more than they increase the civilian option (by raising the dollar value of the separation bonus). Their expectation that women and minorities face a higher cost of leaving due to

discrimination and other institutional factors that might restrict their civilian employment opportunities and potential earnings, was met for minorities, but not for women. They find that minorities are, on average, about five percent less likely to voluntarily separate which is hypothesized to result from the military's favorable climate for equal opportunity and the generally higher unemployment of minorities in the civilian economy. Contradicting existing evidence that women historically have higher reenlistment rates, Mehay and Hogan found that females are more likely to accept the bonus, the reasons of which are unclear. Also of interest are their findings on the effect of ability on the voluntary separation decision. One concern of policy-makers was the possibility that more able personnel would be more likely to leave under the bonus program. Introducing variables for AFQT and education in the models, Mehay and Hogan found mixed evidence on whether the more able are more inclined to leave voluntarily. While their AFQT coefficient suggests that more able personnel face better civilian employment and earnings opportunities and, thus, are more likely to leave, the years of education had a negative effect on accepting the bonus. The effects of family status point also in opposite directions: married personnel were found to be less likely to leave; which may be explained by the fact that military allowances and in-kind benefits are greater for those with dependents. However, those with larger families are more likely to leave which may be explained by the fact that frequent separation associated with active duty is more disruptive to families with children than to married couples without

children. Noteworthy are their findings that the spouse in a dual-military couple has a higher probability to leave than those married to spouses who do not work or who have civilian jobs. This effect is hypothesized to be due to the difficulties of maintaining a normal lifestyle when both spouses are on active duty.

Another interesting part of their study is their estimation of the effect of the VSI/SSB program on voluntary separation behavior. To derive an estimate of those enlisted personnel who would not have left in the absence of the financial incentive program, Mehay and Hogan compared the program separation rates with those during a pre-drawdown year. According to the study, 2/3 of those who left were induced to do so by the financial incentive aspect of the program, i.e., the VSI/SSB program increased the acceptance rate by 200 percent.

Additionally, Mehay and Hogan compared Navy and USAF VSI/SSB separation rates to estimate the effect of the threat of involuntary separation on bonus acceptance behavior. While the threat of reductions-in-force (RIF) was nonexistent in the Navy, the USAF introduced a five-tier system in which the threat of RIF was conditioned on having military occupations that were designated as facing some threat of layoff. While tier 1 was exempt from a potential layoff, the threat of involuntary separation increased with tier 5 having the highest threat of layoff. Incorporating dummy variables for these tiers in their model, Mehay and Hogan found statistical evidence that the threat of a potential layoff significantly increases the probability of accepting the voluntary separation program. Although those who would have been discharged would have

received severance pay, the higher the threat of being separated involuntarily, the more likely the individual would leave and accept the financial incentive program.

III. DATA AND METHODOLOGY

A. DESCRIPTION OF DATA

Data on the population of VSI/SSB eligible personnel were obtained from Defense Data Manpower Center (DMDC), Monterey. The data files contained information on the separation behavior and the demographics of VSI/SSB eligible Navy officers in FY93 and Navy and Air Force enlisted personnel in FY92, the first year of the program for each respective group. The initial Navy officer data set consisted of 15,177 observations of eligible personnel and 126 variables. Because this analysis assumes individuals will retire at 20 YOS, those observations with more than 19 YOS were deleted from the sample. This reduced the size of the officer file to 13,297 observations. Additionally, missing or erroneous data reduced the size of the officer file suitable for empirical analysis to 12,635. The initial data file for Navy enlisted personnel was comprised of 37,886 observations of eligible personnel with 147 variables. Eliminating erroneous or missing data reduced the data set to 34,671 observations. To estimate the effect of RIF on separation behavior, the initial data file on Air Force enlisted personnel eligible for the bonus in FY92 was restricted to only those individuals who explicitly faced a threat of involuntary separation. This limited the file on Air Force VSI/SSB eligible enlisted personnel to service members in paygrades E-5 and E-6 with 9 to 14 years of active service whose occupational specialties were grouped into tiers 2-5 (West, 1992). Restricting the data file on Navy enlisted personnel to individuals with 9

to 14 YOS and merging it with the Air Force file resulted in a combined data set with 70,116 observations, roughly one half of the original 141,360.

Table 3.1 shows some descriptive statistics about the data set of Navy officers in FY93. The acceptance rate was only 6.71 percent. A t-test of differences in means for each variable is displayed in column 5. Using only the significant differences, we find that those who accepted the bonus and left the military were younger, had fewer years of active duty service, were more likely to be single or divorced, were more likely to be an unrestricted line officer, and had fewer dependents.

Table 3.1 Mean Values (or Proportions) of Selected Variables of VSI/SSB Eligible Navy Officers in FY93

	Total	Takers ^a	Non-Takers	t-test
Observations	12,635 (100%)	848 (6.71%)	11,787 (93.29%)	
Age	34.72	32.44	34.89	0.0001*
Years of Service	12.73	10.03	12.92	0.0001*
Gender (%) (male=1)	88.64	87.62	88.72	0.3475
Marital Status (%) (married=1)	81.64	70.40	82.45	0.0001*
Unrestricted Line (%) (URL=1)	64.86	80.66	63.72	0.0001*
Minority (%) (Minority=1)	7.32	6.96	7.35	0.6741
Dependents	3.02	2.57	3.05	0.0001*
Military Spouse (%) (mil. spouse=1)	5.62	5.90	5.60	0.7170

^a those who accepted the VSI/SSB bonus and left the military

* means for takers and non-takers are significantly different at the 99% confidence level

Source: derived from data obtained from DMDC

Also members of a minority group and female officers had, on balance, lower acceptance rates, but the difference in means is not statistically significant. Those married to a military spouse are also found to have statistically similar separation behavior to those married to a civilian spouse.

Table 3.2 lists descriptive statistics for VSI/SSB eligible Navy enlisted personnel in FY92. One difference between tables 3.1 and 3.2 is that the acceptance rate for enlisted personnel is nearly twice that of officers.

Table 3.2 Mean Values of Selected Variables of VSI/SSB Eligible Navy Enlisted Personnel in FY92

	Total	Takers ^a	Non-Takers	t-test
Observations	34,671 (100%)	4,320 (12.46%)	30,351 (87.54%)	
Age	32.56	32.40	32.58	0.0022*
Years of Service	12.86	12.69	12.88	0.0001*
Gender (%) (male=1)	89.72	86.30	90.21	0.0001*
Marital Status (%) (married=1)	78.70	75.97	79.09	0.0001*
AFQT Score	55.25	57.42	54.95	0.0001*
Minority (%) (minority=1)	29.57	18.17	31.19	0.0001*
Dependents	3.19	3.14	3.20	0.0266**
Military Spouse (%) (mil. spouse=1)	5.72	6.64	5.59	0.0088*
Technical Rating (%) (high tech=1)	19.75	22.50	19.35	0.0001*

^a those who accepted the VSI/SSB bonus and left the military

* means for takers and non-takers are significantly different at the 99% confidence level

** means for takers and non-takers are significantly different at the 95% confidence level

Source: derived from data obtained from DMDC

While officers who took the separation bonus tended to be much younger and have fewer YOS, the differences in these variables for enlisted personnel were small. But, because of the larger sample size, these differences are significant for the enlisted group. The same applies for the number of dependents: officers who leave tend to have fewer dependents whereas the difference in the number of children of enlistees is very slight. As was true for officers, married enlisted personnel are much less inclined to accept the financial incentive. Those married to a military spouse and those with higher AFQT scores were, according to expectations, more inclined to leave. In contrast to Navy officers, enlisted males and minorities had significantly lower acceptance rates. Additionally, those enlistees who were trained in a technical MOS had higher program acceptance rates than non-technical enlisted personnel.

Table 3.3 shows relevant descriptive statistics of VSI/SSB eligible Air Force enlisted personnel in FY92 who explicitly faced a threat of involuntary separation. Similar to Navy enlisted personnel, Air Force enlisted who leave are, on balance, younger, have fewer YOS, are more likely to be unmarried, and are less likely to be minorities. As was true for Navy enlisted personnel, females in the Air Force had a significantly higher acceptance rate than males. However, contradicting the findings on Navy enlisted personnel, the USAF "leavers" had, on average, lower AFQT scores, had more dependent children, were less likely to be married to a military spouse (significant at the 90% confidence level), and were more likely to serve in a non-technical MOS.

Table 3.3 Mean Values (or Proportions) of Selected Variables of VSI/SSB and RIF Eligible Air Force Enlisted Personnel in FY92

	Total	Takers ^a	Non-Takers	t-test
Observations	43,842 (100%)	7,536 (17.19%)	36,306 (82.81%)	
Age	30.97	30.72	31.02	0.0001*
Years of Service	11.86	11.65	11.90	0.0001*
Gender (%) (male=1)	86.40	85.34	86.62	0.0040*
Marital Status (%) (married=1)	81.40	79.63	81.77	0.0001*
AFQT Score	55.29	54.78	55.39	0.0119**
Minority (%) (minority=1)	26.57	19.94	27.95	0.0001*
Dependents	3.11	3.15	3.10	0.0011*
Military Spouse (%) (mil. spouse=1)	11.60	10.96	11.73	0.0547
Technical MOS (%) (high tech=1)	46.07	41.07	47.11	0.0001*
Tier 2 (%)	34.23	24.27	36.30	0.0001*
Tier 3 (%)	3.74	3.73	3.75	0.9430
Tier 4 (%)	25.24	28.90	24.48	0.0001*
Tier 5 (%)	36.79	43.10	35.45	0.0001*

^a those who accepted the VSI/SSB bonus and left the military

* means for takers and non-takers are significantly different at the 99% confidence level

** means for takers and non-takers are significantly different at the 95% confidence level

Source: derived from data obtained from DMDC

Surprisingly, the personnel who were grouped in Tier 2 were less inclined to leave while service members in Tier 3 were basically neutral toward the program (statistically insignificant difference in proportions). However, those in Tier 4

and Tier 5 had, according to expectations, higher separation rates, with those in Tier 5 having the largest values.

B. ESTIMATION STRATEGY

1. Development of Model

The specification of the empirical model follows the findings of prior literature on the ACOL model. It is assumed that the utility-maximization framework underlying the ACOL model significantly explains and predicts the decision behavior towards a voluntary separation incentive program and that many of the key factors in the studies presented in the literature review are applicable to the decision to accept a voluntary separation bonus. Using Equation (6) in Chapter II, three separate models were specified: one for Navy officers, one for Navy enlisted personnel and a third for a merged data set of Navy and USAF enlisted personnel. In the models the probability of staying in the military was expressed as:

$$r_i = P(ACOL_i^* > \delta_i) = \beta_0 + \beta_1(ACOL_i^*) + \underline{\lambda}_i \underline{X}_i + \varepsilon_i \quad (8)$$

where r_i represents the probability of staying for individual i , $ACOL_i^*$ is the maximum ACOL value for individual i , δ_i is the individual's net preference for civilian life over military life, $\underline{\lambda}_i$ and \underline{X}_i are the respective vectors of parameters and individual characteristics, and ε_i is a random error term that is assumed to be distributed normally $N(\mu, \sigma^2)$ with mean μ and variance σ^2 .

Table 3.4 displays an overview of the variables used in this analysis. These variables were assumed to significantly affect the decision to take a voluntary separation incentive.

Table 3.4 Definitions of Variables Used in the Probit Separation Models

Variable Name	Definition
STAY	= 0 if accepted the separation bonus = 1 otherwise
ACOL	Annualized Cost of Leaving (\$)
MALE	= 1 if male = 0 if female
MINORITY	= 1 if ethnic minority = 0 otherwise
DEPS	number of dependent children
MILSPOUS	= 1 if spouse also in military = 0 otherwise
URL	= 1 if unrestricted line officer = 0 otherwise
AFQT	score on Armed Forces Qualification Test (in percent)
HITECH	= 1 if in technical occupation = 0 otherwise
TIER2	= 1 if member of tier 2 = 0 if member of Navy or other tier
TIER3	= 1 if member of tier 3 = 0 if member of Navy or other tier
TIER4	= 1 if member of tier 4 = 0 if member of Navy or other tier
TIER5	= 1 if member of tier 5 = 0 if member of Navy or other tier

2. Variable Construction and Definitions

a. *The Dependent Variable*

The dependent variable STAY was constructed from the PROGRAM variable in the original data set. STAY was coded 1 if the individual did not leave the military, and coded 0 if he/she separated with either the VSI or the SSB option of the program.

b. *Calculation of the ACOL Variable*

To calculate the Annualized Cost of Leaving it was assumed that individuals form their expectations of future income streams based on current information about military pay and promotion possibilities and civilian wage opportunities. Since VSI/SSB eligibility criteria focused on mid-career personnel, it can be assumed that the typical offeree in the absence of the bonus program would have stayed in the military until becoming vested for retirement benefits. Thus, the individual's decision was assumed to be between either accepting the incentive and leaving the military immediately or staying until YOS 20. This follows the assumption used by Goldberg (1982) in his analysis of mid-career (third-term) personnel.

To estimate the expected future military income stream, the Navy Officer Master File (OMF) for FY93, the Navy Enlisted Master File (EMF) for FY92 and the Air Force EMF for FY92 were obtained from the Defense Manpower Data Center in Monterey, CA. Each data set was used to compute the paygrade distribution by gender in each relevant year of service (YOS). this

provided the probability of being in a certain paygrade by YOS. This probability was then combined with FY92 and FY93 military pay tables to obtain data on monthly basic pay, Basic Allowance for Quarters (BAQ) conditioned on dependent status, and Federal Insurance Contributions Act (FICA) deductions. These data were combined to calculate the expected annual military income for each YOS. Consistent with Warner and Goldberg (1984), special pays were neglected in the military pay variable since they are relatively small in regard to monthly basic pay and BAQ and were rather designed as a compensating wage differential for the undesirable job characteristics of certain military occupational specialties. Expected future annual military retirement benefits were assumed to be 50 percent of the expected annual military basic pay in YOS 20.

Thus, the present value of the total military income stream associated with staying until YOS 20 in the military can be approximated by summing the discounted expected values of annual military pay until YOS 20 and those of the military retirement benefits from retirement age until life expectancy age (currently 73 and 78 years of age for men and women, respectively). Following Mairs et al (1992), Goldberg (1982) and Warner and Goldberg (1984), a discount rate of ten percent was chosen throughout the analysis.

Assuming that a military retiree remains in the civilian labor market until age 65, a civilian age-earnings profile was calculated using the 1990 Public Use Microdata Samples (PUMS). PUMS data are based on the decennial

census of the U.S. and contain records representing 5 percent or 1 percent samples of the housing units in the U.S. and the persons living in them. Restricting the population in the PUMS data file to a representative sample of only military veterans reduced the size of the data set from 866,383 to 51,212 observations. Controlling for gender, levels of education and whether the individual receives military retirement benefits or not, the estimated age-earnings profile provided approximations of the future civilian income and retirement benefits stream of male and female veterans. Thus, the total present value of the civilian income stream to be expected after military retirement was calculated as the sum of the discounted annual civilian pay from military retirement age until age 65, plus the discounted annual civilian retirement benefits from age 65 until the respective life expectancy age. The present values of the military and civilian income streams were then summed to approximate the individual's perceived pecuniary value of staying in the military.

The same age-earnings profile was then used to calculate the annual expected civilian wage of military veterans with less than 20 YOS (i.e., the value of the civilian option). Consistent with Goldberg and Warner (1987), it was found that veterans who leave the military early have higher civilian earnings than those who stay until YOS 20. Discounting the individual's annual civilian income (conditioned on age) and summing them from the individual's current age until life expectancy age, provides the perceived present value of the civilian income plus civilian retirement stream. Since the majority of those

individuals who accepted a separation incentive chose the SSB lump-sum payment over the VSI annual installments, only the Selective Separation Bonus each individual would receive in case he/she accepted the program was included in the civilian pay stream. The SSB computation was based on paygrade and YOS in the relevant current fiscal year. The SSB payment was added to the present value of the civilian income and retirement benefit stream to obtain the total present value of the returns to be expected if the individual leaves the military.

The cost of leaving (COL) was calculated for each individual as the difference between the present value of staying until 20 YOS and that of leaving immediately. Conditioned on the number of years remaining until 20, the COL values were annualized using the ten percent personal discount rate to obtain the ACOL values. It is hypothesized that ACOL positively affects the probability of staying, i.e., the higher the Annualized Cost of Leaving, the less likely the individual will accept the separation bonus.

c. Demographic Variables

Several demographic factors are also included in the retention models to capture differences in non-pecuniary factors affecting the separation decision. These include the following.

(1) MALE (gender). A dummy variable was added to control for gender-specific differences in separation behavior; MALE = 1 if male, = 0 otherwise. Since the lower expected civilian earnings of women are already

incorporated in the calculation of the ACOL variable, one might expect MALE to be insignificant in the probit retention equation. However, because women are historically the provider of supplementary income in a household and, thus, are more inclined to take a voluntary separation bonus, the MALE variable may have a positive effect on the decision to stay.

(2) MINORITY (member of an ethnic minority). A dummy variable was added to control for racial and ethnic differences in the decision to leave; MINORITY = 1 if the individual's ethnic origin is non-Caucasian, = 0 otherwise. Because the potential civilian earnings of minorities tend to be restricted and this factor is not incorporated in the calculation of the ACOL variable, minority status is hypothesized to be positively correlated with the probability of staying. In other words, their average ACOL values would tend to be higher than those of comparable majority men and women, making them less likely to leave. Thus, the minority variable is included to control for the differences in civilian and military opportunities for minorities.

(3) MARRIED (marital status). MARRIED = 1 if the individual is married, with or without children, and = 0 if he/she is single or divorced. Although the calculation of the ACOL variable controls for marital status-specific differences in military and civilian income streams, military fringe and in-kind benefits (such as health care for the spouse and dependents) may induce married personnel to reject the VSI/SSB program, on balance, more often

than unmarried personnel. Thus, the coefficient of MARRIED is expected to positively affect the decision to stay.

(4) DEPS (number of dependents) is a continuous variable for the number of dependents. Previous research shows that, with increasing family size, individuals seem to prefer the relatively certain and steady military pay over civilian wage. The military's medical health plan and other non-pecuniary benefits are also found to decrease the service members probability of leaving. Thus, the coefficient of DEPS is hypothesized to have a positive sign, indicating that the more children a service member has, the less likely he/she is to separate.

(5) MILSPOUS (military spouse) is a dummy variable coded 1 if the service member is married to a military spouse, with or without children, and 0 otherwise. Due to the difficulties in trying to lead a "normal" marriage when both partners are members of the military, it is assumed that if one of them is offered the VSI/SSB program, he/she may be more inclined to accept the bonus and leave. Thus, the coefficient is hypothesized to be negative.

(6) URL (unrestricted line) is a dummy variable, coded URL = 1 if the individual is an unrestricted line officer and = 0 otherwise. This variable is included in the Navy officer model to control for differences in military tastes of restricted and unrestricted line officers. If unrestricted line officers, due to the rigorous nature of their jobs, have stronger preferences for military life than their restricted line counterparts, then URL will positively affect the

probability of staying. However, if the job characteristics associated with unrestricted line duty are more onerous than those associated with restricted line occupational specialties, unrestricted line officers may be more likely to leave.

(7) AFQT (Armed Forces Qualification Test) is a continuous variable representing an enlisted service member's percentage score on the Armed Forces Qualification Test at his/her entry into the military. If, as feared by policy makers at the introduction of the VSI/SSB program, those with higher aptitude have better employment opportunities in the civilian labor market, and thus, are more inclined to leave the military, the coefficient of AFQT will be negative.

(8) HITECH (technical rating) = 1 if the enlistee's military occupation is technical, = 0 otherwise. Extensive technical training in these ratings is assumed to be more transferable to the civilian labor market should lower the individual's reluctance to accept the program. Thus, the coefficient of HITECH is expected to be negative.

(9) TIER2 to TIER5 (tier 2, tier 3, tier 4, tier 5) are dummy variables coded 1 if the enlistee is in the respective "tier" group, coded 0 if he/she serves in the Navy or is in a different tier. The coefficients are expected to become increasingly negative, with TIER5 having the largest negative value due to the associated rise in the threat of involuntary separation.

Summarizing, the specifications of the three STAY probit models are displayed below. The expected sign of each variable represents the preliminary hypothesis about its effect on the probability of staying.

The probit model for Navy officers:

$$STAY = f(ACOL^+, MALE^{?/-}, MINORITY^+, MARRIED^+, DEPS^+, MILSPOUS^-, URL^?) \quad (9)$$

The probit model for Navy enlisted personnel differs from (9) by including AFQT and HITECH , but by excluding URL:

$$STAY = f(ACOL^+, MALE^{?/-}, MINORITY^+, MARRIED^+, DEPS^+, MILSPOUS^-, AFQT^-, HITECH^-) \quad (10)$$

The probit model that pools Navy and USAF enlisted personnel differs from (10) by including the TIER dummies:

$$STAY = f(ACOL^+, MALE^{?/-}, MINORITY^+, MARRIED^+, DEPS^+, MILSPOUS^-, AFQT^-, HITECH^-, TIER2^-, TIER3^-, TIER4^-, TIER5^-) \quad (11)$$

IV. EMPIRICAL RESULTS

A. ANALYTIC METHODS

This chapter describes the estimation methods used in this thesis. It also discusses and interprets the results of the empirical analysis.

Sections B and C present and discuss the findings on the effect of the VSI/SSB program on the voluntary separation behavior of Navy officers and enlisted personnel, respectively. To estimate these effects, the multivariate probit models (Equations 9-10 above) are estimated to determine the direction and the magnitude of the variables introduced in Chapter III. These models are estimated with data on VSI/SSB-eligible Navy officers in FY93 and enlisted personnel in FY92. This was the first year of the program for each respective group. The models estimate the effect of the separation program holding other factors constant.

Section D presents and discusses the results of the influence of the threat of involuntary separation on voluntary separation behavior. The effect of the threat of involuntary separation in combination with the VSI/SSB program is estimated by merging data on VSI/SSB eligible-Navy with data on Air Force enlisted personnel that were subject to involuntary separation in FY92. Controlling for differences in the level of the separation threat, holding all other factors constant, probit models are estimated to determine the direction and the magnitude of the Air Force's five-tier separation system and the related RIF on

voluntary separation behavior. This model was specified as Equation (11) above.

This chapter also provides an analysis of the marginal probabilities associated with each explanatory variable in the various models. Contrary to linear probability models, where the direct effect of each independent variable on the probability of the event can be easily determined from the estimated coefficients, probit models must be evaluated at the mean values of the explanatory variables. The marginal probability is the change in the probability of staying in the military associated with a one unit change in a specific independent variable, holding everything else constant. To obtain the marginal probabilities, the probability of staying in the military for the "notional" (or average) person (i.e., a fictitious individual whose values of the independent variables were set at the respective mean or median values of the entire population used for this model) are calculated. Holding everything else constant, each continuous variable is changed by one unit from its mean value and following this, the probability of staying for this "new" individual will be calculated. For dummy variables, the value is changed from 0 to 1 or from 1 to 0 and the corresponding probability calculated. The difference in the two resulting probabilities is an estimate for the change in the probability of the outcome (STAY) for a one unit change in the specific explanatory variable.

Additionally, this chapter estimates the average effects of the VSI/SSB program on the program acceptance rate. For each individual observation in the

three sample groups, the probability of accepting the financial bonus is predicted by using the respective estimated probit regression. This yields the individual's simulated probability of leaving the military with the inclusion of the SSB in the ACOL variable. The individual probability of accepting in the absence of the financial bonus is predicted by using the ACOL without including the SSB in the estimated probit models. Thus, the average effect of the VSI/SSB program ($\bar{\hat{P}}_{SSB}$) is estimated as in Equation (12) below:

$$\bar{\hat{P}}_{SSB} = \frac{\sum_{i=1}^n (\hat{P}_{1_i} - \hat{P}_{2_i})}{n} \quad (12)$$

where \hat{P}_{1_i} is the individual's simulated probability of leaving with the inclusion of the SSB in the calculation of the ACOL variable, \hat{P}_{2_i} is his/her simulated probability of leaving without including the financial offer in the ACOL variable, and n stands for the number of observations in the respective sample.

B. THE EFFECT OF THE VSI/SSB PROGRAM ON THE VOLUNTARY SEPARATION BEHAVIOR OF NAVY OFFICERS IN FY93

This section presents the results of the analysis of VSI/SSB-eligible Navy officers in FY93, the first year in which this program was offered to them. Before analyzing the separation behavior in a multivariate context, a bivariate analysis of average ACOL values and their associated separation rates, both conditioned on years of service, was conducted as a preliminary analysis of the relationship between ACOL and separation behavior. As can be seen from Table 4.1, the

average ACOL values initially decrease until 12 YOS, after which they start to rise.

Table 4.1 Average ACOL Values and Program Acceptance Rates by YOS for Navy Officers in FY93

YOS	observations	ACOL	Acceptance Rate (%)
7	296	5,511	18.24
8	1,538	6,881	19.12
9	1,143	6,449	12.16
10	1,120	6,034	8.48
11	1,039	5,793	8.08
12	1,014	5,301	4.24
13	1,078	5,719	2.69
14	1,168	5,833	1.97
15	1,183	5,961	2.45
16	890	7,759	2.47
17	739	9,787	1.62
18	735	13,297	1.50
19	692	24,276	1.88
total	12,635	7,794	6.71

Source: calculations by author, derived from data obtained from DMDC

Table 4.1 illustrates that, on balance, acceptance rates decline with YOS, but the ACOL values initially decrease until YOS 12 and increase subsequently until YOS 19. The rise in the ACOL after YOS 12 can be explained by the increasing attractiveness of the military retirement program. However, the relatively large variability in the acceptance rate, given the almost constant ACOL values of certain YOS ranges, implies that the variation in the ACOL

value only partially explains the change in the acceptance rate. Thus, the multivariate models are specified to control for other demographic and taste-related variables.

The multivariate probit model is used to identify the factors affecting the separation behavior of VSI/SSB-eligible Navy officers in FY93. The dependent variable represents a binary choice, to stay or leave. This choice was modeled as a function of the Annualized Cost of Leaving and a vector of demographic variables, which were listed in Equation (9) above. Table 4.2 presents the estimated probit coefficients of the explanatory variables, the significance level of each coefficient, and the calculated marginal effects of each variable. With the exception of the ACOL variable, the value of the marginal probability represents the change in the probability of staying for a one unit change in the respective independent variable. Since one major research issue of this thesis is to determine the separation rate due to the program, i.e., what the separation rate would have been in the absence of the VSI/SSB program, the marginal effect of the ACOL variable was computed by calculating the difference in the simulated probabilities of a "notional" individual with and without the inclusion of the Special Separation Bonus in the ACOL calculation. Thus, this marginal probability is an estimate of the effect of the VSI/SSB program on the decision behavior of bonus eligible personnel.

As hypothesized, the ACOL variable was found to be statistically significant and its effect on the probability of staying is positive. Although

relatively small, the probit coefficient of the ACOL variable is similar to the findings of Mairs et al (1992) for a sample of U.S. Army officers.

Table 4.2 Probit Regression Results of Navy Officers in FY93

Variable	Coefficient	Wald χ^2	Pr > χ^2	$\Delta P_i / \Delta X^a$ (Marginal Effect)
INTERCEPT	1.2308	165.78	0.0001*	
ACOL	0.000012	17.54	0.0001*	3.212 ^b
MALE	0.0330	0.23	0.6316	0.457
MARRIED	0.2543	18.46	0.0001*	4.126
MINORITY	0.0269	0.16	0.6938	0.357
DEPS	0.0702	16.44	0.0003*	0.903
MILSPOUS	-0.0107	0.02	0.9005	-0.145
URL	-0.3548	75.21	0.0001*	-3.675

Model Chi-Square = 208.045 with 7 DF (p = 0.0001); n = 12,635

^a change in probability of staying for a one unit change in the explanatory variable, calculated at the mean values.

^b change in probability of staying in the absence of the separation bonus, calculated at the mean values.

* significant at the 99% confidence level

Source: derived from data obtained from DMDC

The marginal effect for the ACOL variable as listed in column 5 of Table 4.2 provides an estimate of the increase in the likelihood of staying if DoD would not have instituted the financial bonus. Table 4.3 displays both the simulated program acceptance rates for the notional person (repeated from Table 4.2) and the predicted probability of leaving averaged over the sample group with and without the inclusion of the separation bonus in the ACOL variable. This is called the average treatment effect.

Table 4.3 Predicted Probabilities of Accepting (%)

	With SSB	Without SSB	Difference in Probabilities With and Without the SSB
Notional Person	7.074	3.862	3.212
Averaged over Sample	6.700	4.623	2.077

Source: derived from data obtained from DMDC

Thus, the VSI/SSB program increased the probability of leaving for the notional person by 3.212 percentage points, a relative increase of 83.17 percent. The average program effect is estimated to be an increase in the acceptance rate by 2.077 percentage points, a relative increase of 44.93 percent.

Using these measures of the program effect we can calculate the costs and benefits of the separation bonus program. Using the more conservative estimate of 2.077 points, it is estimated that out of the 848 officers who left, 585 would have done so even in the absence of the bonus. Hence, 263 service members were induced to leave by the voluntary separation bonus. With an average SSB amount of \$56,813 for officers who left, the Navy paid the 848 "leavers" a total of \$48.18 million in financial incentives. Since about two thirds (68.99%) would have left anyway, about \$33.24 million accrued to separatees as economic rents. On the other hand, about one third of those who separated would have stayed in the absence of the program. Thus, the economic benefits of the program accrue in the form of the future military pay and retirement benefits that are saved by inducing those 263 people to leave. These benefits were calculated by using the average demographic characteristics of the group

of leavers. However, comparing the immediate program cost of \$48.18 million with the long-term benefits we must calculate the present value of the future savings stream. Using the official government real discount rate of 3.8 percent for a period of 30 years or more, the average present value of the future savings per individual was calculated to be \$720,435 per leaver.² Thus, the economic benefit of the separation bonus program was estimated to be \$189.5 million (263 leavers * \$720,435), almost four times the immediate cost of the program. For the program to break-even, at these acceptance rates it would have needed only 67 individuals to be stimulated to leave (\$48.18 M / \$0.720 M).

We now address the coefficients of the demographic variables. The variable MALE has a negative coefficient but is statistically insignificant. This indicates that after controlling for the typically lower civilian income for women, female Navy officers show statistically similar separation behavior to males, thus contradicting the findings of Mairs et al (1992) on the effect of gender on voluntary separation behavior of Air Defense Artillery officers. However, Mairs et al's conclusion that females are more likely to stay can be attributed to the fact that the authors did not control for the gender-specific differences in post-military earnings in their ACOL calculation, thus their coefficient for gender will be upward biased, since it will "pick up" the effect of differences in the cost of leaving.

² The real discount rate to be used in evaluating time-distributed costs and benefits for Government agencies was taken out of the Office of Management and Budget (OMB) Circular No. A-94, October 29, 1992.

The MARRIED and DEPS variables are both statistically significant at the 99% confidence level. The coefficients of both variables are positive, as hypothesized, indicating that being married and a larger number of dependents both raise the probability of staying. Since differences in both civilian and military earnings due to marital status are incorporated in the calculation of the ACOL variable, the positive coefficient of the MARRIED variable indicates that married personnel have stronger preferences for military life. Military fringe and in-kind benefits appear to be more highly valued by married than by single personnel as well as by officers with dependents. The military's medical health plan for dependents is hypothesized to be a major reason for this difference in voluntary separation behavior.

Contrary to expectations, the coefficient of the MINORITY variable was found to be positive, but statistically insignificant. Thus, being a member of a minority group does not significantly affect the decision to accept the VSI/SSB program. The reason for this behavior is unclear, but it could be that officers, who typically have college degrees, perceive race-specific differences in post-military earnings to be insignificant at their levels of education.

The MILSPOUS variable is statistically insignificant, thus indicating that spouses in a dual military partnership have the same program acceptance rates as officers who are married to a civilian spouse. This contradicts previous research on enlisted personnel (Mehay and Hogan, 1995) and indicates that the pursuit of a successful career seems to be more prominent for officers than for

enlisted personnel, making either partner in a dual-military relationship reluctant to sacrifice his/her own career for the sake of their marriage.

The coefficient of the URL variable is statistically significant at the 99% confidence level and its sign is negative. This indicates that officers in combat-type military occupations are more inclined to accept the VSI/SSB program. The reason may be that the more rigorous life associated with unrestricted line occupations, for example long sea deployments, creates a strong distaste for military life.

C. THE EFFECT OF THE VSI/SSB PROGRAM ON THE VOLUNTARY SEPARATION BEHAVIOR OF NAVY ENLISTED PERSONNEL IN FY92

This section presents the findings on the effect of the VSI/SSB program on the voluntary separation behavior of Navy enlisted personnel in FY92, the first year the program was offered. Similar to the previous analysis of Navy officer's program acceptance behavior, a bivariate analysis of average ACOL values and voluntary separation rates, both conditioned on YOS, was conducted prior to specifying a multivariate model. Table 4.4 lists the number of observations, the average ACOL values and the program acceptance rates by YOS.

Table 4.4 Average ACOL Values and Program Acceptance Rates by YOS for Navy Enlisted Personnel in FY92

YOS	observations	ACOL	Acceptance Rate
10	4,784	4,889	15.18%
11	5,943	6,524	13.55%
12	5,644	7,967	12.33%
13	5,167	10,332	10.99%
14	4,736	12,832	11.25%
15	4,179	17,081	12.18%
16	3,029	23,759	10.83%
17	1,189	35,485	13.04%
total	34,671	11,734	12.46%

Source: derived from data obtained from DMDC

Table 4.4 shows that although mean ACOL values rise with YOS, the program acceptance rates remain relatively constant, indicating that the ACOL may not have a significant influence on the voluntary separation behavior of the VSI/SSB-eligible group of Navy enlisted personnel in FY92. However, this bivariate analysis does not control for differences in gender, race or other demographic characteristics. Thus, unobserved differences in demographics may be the source of the small variation in the average program acceptance rates. Table 4.5 shows the results of estimating the multivariate probit regression model, the estimated coefficients, and the marginal effects from each variable.

Table 4.5 Probit Regression Results of Navy Enlisted Personnel in FY92

Variable	Coefficient	Wald χ^2	Pr > χ^2	$\Delta P_i / \Delta X^a$ (Marginal Effect)
INTERCEPT	0.7813	294.07	0.0001*	
ACOL	0.00000335	8.06	0.0045*	0.534 ^b
MALE	0.2553	70.62	0.0001*	6.158
MARRIED	0.1193	20.87	0.0001*	2.682
DEPS	-0.0239	10.51	0.0012*	-0.509
MINORITY	0.3767	293.95	0.0001*	6.322
MILSPOUS	-0.0386	0.96	0.3262	-0.831
HITECH	-0.0557	6.09	0.0135**	-1.209
AFQT	0.000135	0.12	0.7331	0.0028

Model Chi-Square = 440.709 with 8 DF (p = 0.0001); n = 34,671

^a change in probability of staying for a one unit change in the explanatory variable, calculated at the mean values.

^b change in probability of staying in the absence of the separation bonus.

* significant at the 99% confidence level

** significant at the 95% confidence level

Source: derived from data obtained from DMDC

The coefficient of the ACOL variable is statistically significant at the 99% confidence level and, as expected, its sign is positive. The small magnitude of the ACOL coefficient, 0.0000035, confirms the previous findings presented in Table 4.4 that the ACOL apparently has only a relatively minor influence on VSI/SSB program acceptance rates. Table 4.6 illustrates the predicted probabilities of accepting with and without the SSB using the notional person approach and the average predicted probability over the complete sample (average treatment effect).

Table 4.6 Predicted Probabilities of Accepting (%)

	With SSB	Without SSB	Difference in Probabilities With and Without the SSB
Notional Person	12.905	12.374	0.531
Averaged over Sample	12.459	11.957	0.502

Source: derived from data obtained from DMDC

Table 4.6 shows that the offer of the SSB increased the average individual's probability of accepting by 0.531 percentage points, a relative increase of 4.29 percent. The average program effect is estimated to be an increase in the separation rate of 0.502 percentage points, a relative increase of 4.20 percent. Thus, of the 4,320 enlistees who chose to accept the program in FY 92, it is estimated that 4,146 would have left even in the absence of the bonus; the financial incentive induced only 174 sailors to separate. With an average SSB of \$36,223, the total cost that the Navy incurred by paying those who left the voluntary separation bonus is estimated to be \$156.5 million. The economic benefits again consist of the cost savings that accrue to the Navy due to inducing 174 service members to leave. Using the same procedures to calculate the present value of the cost savings for enlisted personnel as in the Navy officer file, it is estimated that the Navy saved, on average, a present value of \$537,294 per "leaver". Thus, the present value of the economic benefit for the Navy is estimated to be \$93.49 million, yielding a benefit-cost ratio of 0.60.

However, this estimated program effect seems to be implausibly low. As shown in Table 4.3, individuals with comparatively high ACOL values had, on

average, similar program acceptance rates than enlistees with lower ACOL values. Since the amount of the financial separation bonus increases with tenure, it may be possible that the high amount of the bonus has a "blinding" effect on the individual, thus making him/her incapable of rationally choosing between staying or leaving. In this case, the effect of the VSI/SSB program on voluntary separation behavior would be significantly higher. On the other side, the small variation in the acceptance rates by YOS may be explained by a relatively stronger distaste for military life with increasing tenure, the reasons for which may hinge on repeated sea duty. Contradicting evidence on retention and reenlistment rates, this would mean that those with higher values of ACOL and longer tenure have stronger net preferences for civilian life and probably would have left even without a financial incentive, if they were just let out of their enlistment contract. In this case, the effect of the financial separation bonus on the decision to leave would be, as estimated above, minimal.

In contrast to the above findings on VSI/SSB eligible officers, gender significantly affects the voluntary separation behavior of Navy enlisted personnel. The coefficient of MALE is positive, indicating that male enlistees are more likely to stay, thus duplicating Mehay and Hogan's (1995) findings on gender. Since gender-specific differences in post-military earnings were included in the calculation of the ACOL variable, the positive coefficient of the MALE variable shows that the female population of the sample had, on average, higher net preferences for civilian life. The reasons for this difference in

male/female voluntary separation behavior between enlisted personnel and officers are unclear but could be that female enlistees, in contrast to female officers, are more likely to be the provider of supplemental income in a household, less likely to pursue a career of their own, and thus, more inclined to accept the VSI/SSB program.

The coefficient of the **MARRIED** variable is statistically significant at the 99% confidence level and its sign is positive, indicating that married personnel are more likely to stay. This duplicates the above presented findings on the VSI/SSB eligible Navy officers in FY92. Military fringe and in-kind benefits are apparently perceived to be of higher value to married personnel, which may explain their reluctance to leave.

In contrast to expectations and to the respective findings on Navy officers, the number of dependent children was found to significantly reduce the probability of staying for Navy enlisted personnel, thus indicating that service members with more children are more likely to accept the VSI/SSB program. This reproduces the findings of Mehay and Hogan (1995) and may be explained by the fact that the frequent separation associated with active duty are more disruptive to families with children than to married couples without children.

The **MINORITY** variable is statistically significant at the 99% confidence level. The sign of the coefficient is positive, as hypothesized, thus indicating that members of a minority group are less likely to accept the voluntary separation program. This supports previous research which suggests that

minorities are more likely than whites to stay in the military because of perceived higher levels of discrimination in the civilian labor market.

The MILSPOUS variable is statistically insignificant. Contrary to Mehay and Hogan's (1995) findings on VSI/SSB eligible Navy enlisted personnel, enlistees married to a military spouse were not more likely to accept the voluntary separation bonus than those who in a military-civilian partnership.

The HITECH variable is statistically significant at the 95% confidence level. As hypothesized, the sign of the coefficient is negative, indicating that extensive technical training which is supposed to be more transferable to the civilian labor market, lowers the individual's probability of staying in the military.

The AFQT variable is statistically insignificant, indicating that Navy enlistees with higher aptitude, although speculated to face better civilian employment opportunities, are no more likely to leave the military than those with lower AFQT scores. Thus, the fear of policymakers that the introduction of the VSI/SSB program could possibly recreate the "hollow force" of the 1970's appears to be unfounded.

D. THE EFFECT OF THE THREAT OF REDUCTIONS-IN-FORCE (RIF) ON THE VOLUNTARY SEPARATION BEHAVIOR OF ENLISTED PERSONNEL IN FY92

This section presents and discusses the findings on how the threat of involuntary separation affected enlisted personnels' decisions to accept the VSI/SSB program. As previously mentioned, data files on VSI/SSB-eligible Navy

and USAF enlisted personnel in FY92 were combined into a merged data set that was restricted to observations of individuals who satisfied both Navy and Air Force VSI/SSB eligibility criteria and of Air Force enlisted who were subject to the threat of being involuntary separated. This limited the combined data set to service members in pay grades E-5 or E-6 with 10 to 14 years of active service (West, 1992).

Table 4.7 illustrates how the subpopulations of "takers" and "non-takers" are comprised of Navy and Air Force personnel and how the acceptance decision differed by tier. Column 1 shows that about 37.5 percent of the total sample are Navy members while the remaining 62.5 percent are comprised of Air Force enlisted. This proportion is further split into the respective tiers. Column 2 and 3 display how the subpopulations of "takers" and "non-takers" are comprised of. As expected, Navy enlisted personnel are more likely to stay while comparable Air Force members are more likely to accept the VSI/SSB program.

Splitting the USAF population into the respective tiers reveals that those service members in tier 2 are less likely to leave while those in tiers 4 and 5 are more likely to accept the separation bonus. The acceptance rates for personnel grouped into tier 3 do not significantly differ in means.

Table 4.7 Composition of VSI/SSB Program Takers^a and Non-Takers

	Total	Takers	Non-Takers	t-test
Observations	70,116 (100%)	10,864 (15.49%)	59,252 (84.51%)	
Navy	37.47%	30.63%	38.73%	0.0001*
USAF	62.53%	69.37%	61.27%	0.0001*
Tier 2	21.40%	16.84%	22.24%	0.0001*
Tier 3	2.34%	2.59%	2.30%	0.9430
Tier 4	15.78%	20.05%	15.00%	0.0001*
Tier 5	23.01%	29.89%	21.73%	0.0001*

^a those who accepted the VSI/SSB bonus and left the military

* averages for takers and non-takers are significantly different at the 99% confidence level

Source: derived from data obtained from DMDC

To estimate the effect of the threat of RIF on VSI/SSB acceptance rates in a multivariate context, two models that differed only in the way the ACOL variable is computed, are specified. In Model I, the ACOL variable is calculated using the same procedures as in the previous models on Navy officers and enlisted personnel. Included in the model specification are dummy variables (TIER2-TIER5) to control for being in a specific tier, with Navy enlisted personnel being the base case. However, since the threat of involuntary separation typically decreases an individual's true cost-of-leaving, the estimated probit coefficients of the dummy variables for TIER2-TIER5 are expected to be upward biased. To reduce this upward bias, estimates of the tier-specific probabilities of being involuntarily separated are included in the ACOL

calculations in Model II. The returns of staying RS_i^* for an individual who faces a future risk of being discharged is calculated using the following algorithm:

$$RS_i^* = p_{ti} * (RL_i + SevPay_i) + (1 - p_{ti}) * RS_i \quad (13)$$

where p_{ti} is the tier-specific probability of being RIF'd for individual i , RL_i are the returns of leaving the military immediately, $SevPay_i$ is the amount of severance pay the service member would receive in the event he/she would be involuntarily discharged at some future point, and RS_i are the returns of staying for an individual who faces no threat of involuntary separation. Equation (13) will tend to reduce the ACOL for those service members who are threatened by involuntary separation. Thus, the coefficient of this adjusted ACOL is expected to capture the true increase in the acceptance rate associated with VSI/SSB and the resulting probit coefficients of TIER2 to TIER5 are expected to be unbiased estimators of the effect of involuntary separation on VSI/SSB program acceptance behavior. Since the size of the RIF depended on the success of the VSI/SSB program, the tier-specific threat of being involuntarily separated was not quantifiable in early FY92, the time period on which this analysis focuses. Thus, Model II assumes that the probability of RIF was 20, 30, 40, and 50 percent for tiers 2 - 5, respectively.

1. Model I: Calculating the ACOL Value Without Including the Tier-Specific Threat of Involuntary Separation

Table 4.8 lists the results of the multivariate probit model on VSI/SSB eligible Navy and Air Force enlisted personnel without including the Air Force's threat of involuntary separation in the calculation of the ACOL variable.

Table 4.8 Probit Regression Results of Navy and Air Force Enlisted Personnel in FY92

Variable	Coefficient	Wald χ^2	Pr > χ^2	$\Delta P_i / \Delta X^a$
INTERCEPT	0.5878	200.86	0.0001*	
ACOL	0.000016	85.67	0.0001*	1.812 ^b
MALE	0.2699	140.09	0.0001*	6.545
MARRIED	0.1885	101.63	0.0001*	4.385
DEPS	-0.0352	46.67	0.0001*	-0.753
MINORITY	0.3298	512.45	0.0001*	5.685
MILSPOUS	-0.0164	0.50	0.4812	-0.347
HITECH	-0.0019	0.02	0.8902	-0.039
AFQT	0.0012	15.57	0.0001*	0.024
TIER2	0.0450	6.18	0.0129**	0.922
TIER3	-0.1651	18.72	0.0001*	-3.793
TIER4	-0.2717	243.09	0.0001*	-6.592
TIER5	-0.2991	385.02	0.0001*	-7.357

Model Chi-Square = 1426.068 with 12 DF ($p = 0.0001$); $n = 70,116$

^a change in probability of staying for a one unit change in the explanatory variable, calculated at the mean values.

^b change in probability of staying in the absence of the separation bonus.

* significant at the 99% confidence level

** significant at the 95% confidence level

Source: derived from data obtained from DMDC

The coefficient of TIER2 is found to be significant at the 95% confidence level, but, contrary to expectation, has a positive sign. This indicates that service members in tier 2 are less inclined to accept the financial separation bonus. An explanation for this behavior might be that enlistees in tier 2 perceived themselves to be relatively safe from involuntary separation, because personnel in tier 2 would only be minimally affected while those in tiers 3 to 5 would bear the main burden of a potential RIF. This might have been interpreted as being more or less exempt from involuntary separation, which may have lowered the probability of accepting the VSI/SSB program.

The coefficients of TIER3 to TIER5 are all significant at the 99% confidence level. As hypothesized, their signs are negative and the magnitude of the coefficients increase from TIER3 to TIER5, indicating that the higher the threat of RIF the higher the probability of accepting the financial separation bonus.

Table 4.9 illustrates the marginal effects of the tier-specific threat of involuntary separation on the average individual. The column labeled "No Threat of RIF" lists the predicted probability of leaving for the average individual in the sample without the threat of involuntary separation. The column "Threat of RIF" shows the tier-specific simulated acceptance probabilities for the notional person if he/she were in the respective tier and subject to involuntary separation.

Table 4.9 Predicted Probabilities of Accepting VSI/SSB for the Notional Person With and Without the Threat of Involuntary Separation

	No Threat of RIF	Threat of RIF	Difference in Probabilities With and Without the Threat of RIF
TIER2	12.862	11.941	-0.921
TIER3	12.862	16.655	3.793
TIER4	12.862	19.454	6.592
TIER5	12.862	20.219	7.357

Source: derived from data obtained from DMDC

The respective marginal effects indicate that TIER5 had the largest influence on program acceptance rates. Being in tier 5 is estimated to increase the probability of leaving for the notional person by 7.357 percentage points, a relative increase of 57.2 percent.

The average effects of the threat of involuntary separation on program acceptance rates are listed in Table 4.10. The results are very similar to those presented in Table 4.9 with TIER5 increasing the acceptance rate by 7.233 percentage points, a relative increase of 56.36 percent.

Table 4.10 Predicted Probabilities of Accepting VSI/SSB Averaged over Sample Group With and Without the Threat of Involuntary Separation

	Threat of RIF	No Threat of RIF	Difference in Probabilities With and Without the Threat of RIF
TIER2	12.175	13.098	-0.923
TIER3	17.177	13.335	3.842
TIER4	19.650	13.068	6.582
TIER5	20.066	12.833	7.233

Source: derived from data obtained from DMDC

However, as previously discussed, the threat of future involuntary separation may reduce the individual's perceived ACOL. Thus, the above findings on TIER3 to TIER5 can be expected to be biased upward while the estimated effect of TIER2 on the program acceptance behavior may be biased downward. This particular problem is addressed in the following paragraph.

2. Model II: Calculating the ACOL Value Using Assumed RIF Probabilities

Table 4.11 illustrates the results for the probit regression of the merged data set where the ACOL values were conditioned on the tier-specific threat of involuntary separation, assuming 20%, 30%, 40%, and 50% probability of being discharged for tier 2 to tier 5, respectively. As expected, the marginal effects of the dummy variables TIER3 to TIER5 decrease in magnitude when the ACOL variable is adjusted for the tier-specific threat of reductions-in-force. This suggests that the previous estimates of the effect of the threat of involuntary separation on program acceptance behavior were upward biased. The marginal effect of TIER2 is found to be larger in magnitude than that of the model with the unadjusted ACOL value, which also follows the above hypothesis that the effect of TIER2 was previously downward biased in Model I.

Table 4.11 Probit Regression Results of Navy and Air Force Enlisted Personnel in FY92 With the Inclusion of the Threat of RIF in the ACOL Calculation^a

Variable	Coefficient	Wald χ^2	Pr > χ^2	$\Delta P_i / \Delta X^b$ (Marginal Effect)
INTERCEPT	0.6685	235.20	0.0001*	
ACOL	0.000013	36.08	0.0001*	1.579 ^c
MALE	0.2227	100.00	0.0001*	5.480
MARRIED	0.1722	85.42	0.0001*	4.132
DEPS	-0.0339	43.46	0.0001*	-0.757
MINORITY	0.3275	505.86	0.0001*	5.936
MILSPOUS	-0.0117	0.25	0.6158	-0.257
HITECH	-0.0003	0.00	0.9840	-0.006
AFQT	0.0010	12.02	0.0005*	0.022
TIER2	0.0683	13.12	0.0003*	1.441
TIER3	-0.1325	11.55	0.0007*	-3.115
TIER4	-0.2245	128.12	0.0001*	-5.527
TIER5	-0.2362	148.60	0.0001*	-5.849

Model Chi-Square = 1376.507 with 12 DF (p = 0.0001); n = 70,116

^a this model assumes a tier-specific threat of involuntary separation of 20%, 30%, 40%, and 50% for tier 2 to tier 5, respectively

^b change in probability of staying for a one unit change in the explanatory variable, calculated at the mean values.

^c change in probability of staying in the absence of the separation bonus.

* significant at the 99% confidence level

Source: derived from data obtained from DMDC

Whereas in Model I the marginal effect of TIER2 decreased the average probability of leaving by 0.922 percentage points, in Model II with the adjusted ACOL value this effect rises to a difference of 1.441 percentage points. The reestimated effects on the probability of accepting the VSI/SSB program of variables TIER3 to TIER5 all decrease in magnitude, with the most significant

reduction for variable TIER5. Incorporating the threat of involuntary separation in the calculation of the ACOL variable decreases the marginal effect of TIER5 from 7.357 percentage points to 5.849 percentage points. The marginal effects of the tier dummy variables on program acceptance rates are displayed in Table 4.12. It shows that, even though the threat of involuntary separation lowers the ACOL value, the threat of being RIF'd still increases the voluntary separation rate substantially. The estimated marginal effect of TIER5 represents a relative increase in the acceptance rate of 42.74 percent.

Table 4.12 Predicted Probabilities of Accepting VSI/SSB for the Notional Person With and Without the Threat of Involuntary Separation^a

	No Threat of RIF	Threat of RIF	Difference in Probabilities With and Without the Threat of RIF
TIER2	13.686	12.245	-1.441
TIER3	13.686	16.801	3.115
TIER4	13.686	19.213	5.527
TIER5	13.686	19.535	5.849

^a 20%, 30%, 40%, and 50% threat of involuntary separation included in the calculation of the ACOL value

Source: derived from data obtained from DMDC

Table 4.13 illustrates the predicted probabilities of accepting the program averaged over the entire sample. Comparing it with the figures presented in Table 4.10 reveals that, as expected, the averaged effects of variables TIER3 to TIER5 decreased in magnitude while the influence of TIER2 increased.

Table 4.13 Predicted Probabilities of Accepting VSI/SSB Averaged over Sample With and Without the Threat of Involuntary Separation^a

	Threat of RIF	No Threat of RIF	Difference in Probabilities With and Without the Threat of RIF
TIER2	12.208	13.631	-1.423
TIER3	17.210	14.070	3.140
TIER4	19.699	14.122	5.577
TIER5	20.126	14.226	5.900

^a 20%, 30%, 40%, and 50% threat of involuntary separation included in the calculation of the ACOL value

Source: derived from data obtained from DMDC

The findings of Model I and Model II on the effect of the tier-specific threat of involuntary separation on the service member's probability of accepting the separation bonus illustrate that the threat of potential RIF is a significant complement to a VSI/SSB program. Whereas individuals in tier 2 (lowest threat) are found to be actually less likely to leave voluntarily, those in tiers associated with higher threats of RIF are more likely to take the bonus and leave the military. If the Navy had threatened to conduct RIF in the event the acceptance figures of the VSI/SSB program were found to be insufficient to meet the future force strength, the above results indicate that the financial separation bonus would have been accepted to a significantly higher degree. In the event the Navy had implemented a system similar to the Air Force's five tier system, the conservative figures presented in Table 4.13 imply that the threat of involuntary separation would have increased the acceptance rate of Navy enlisted personnel from 4,320 to 5,963, a relative increase of 38.03 percent.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

This thesis conducted an analysis of the effect of the cost of leaving on the voluntary separation behavior of Navy officers and Navy enlisted personnel. The analysis performed in the thesis was primarily concerned with statistically identifying the proportion of those who separated that would have left even in the absence of the VSI/SSB program and the proportion that was induced to leave by the financial bonus. The utility-maximization framework of occupational decision making and the Annualized Cost of Leaving Model were used to specify retention models. Multivariate probit models were estimated to derive the effect of the Special Separation Bonus (SSB) on the decision to accept the VSI/SSB program. Estimating the model for VSI/SSB-eligible Navy officers in FY93 found that out of the 848 officers who left, 585 would have done so even in the absence of the bonus and 263 were induced to leave by the bonus. Using these figures, the economic benefits of the program in the form of savings in future military pay and retirement benefits was \$189.5 million; the immediate program costs were computed to be \$48.8 million.

The multivariate probit model for VSI/SSB-eligible Navy enlisted in FY92 found that only 174 sailors out of 4,320 were induced to leave by the incentive program. That is, 4146 would have left even in the absence of the financial bonus program. In this case, program costs of \$156.5 million exceeded the economic benefits of \$93.49 million. However, the above estimates for enlisted

personnel seem to be implausibly low. There are several reasons why the VSI/SSB program produced such an implausibly small effect in our estimates. For one thing, the discount rate adopted, 10 percent, may be too low. A higher discount rate would tend to discount the military pay stream by more than the civilian income stream, thus reducing the cost of leaving. For another, the assumption that enlisted personnel would stay until 20 YOS may not be supportable. These issues should be investigated in follow-on research.

This thesis also estimated the effect of the threat of a reduction-in-force (involuntary separation) on bonus acceptance decisions for Navy and Air Force enlisted personnel in FY92. As hypothesized, the threat of a future involuntary separation significantly increases the probability of accepting the financial bonus. However, the potential costs associated with a RIF would be immense. Such a policy could be interpreted as "opportunistic" behavior on the part of DoD and, thus, future retention and recruitment problems might be created by implementing involuntary separation policies. Additionally, morale and motivation of those remaining in the military might be severely reduced. Thus, although the threat of involuntary separation was found to be an effective complement to a VSI/SSB program, the impact of a major RIF on politics, society, and the military may be more detrimental than the potential cost savings associated with such a policy.

B. RECOMMENDATIONS FOR FUTURE RESEARCH

This thesis provided an analysis of the VSI/SSB acceptance behavior of Navy officers and Navy enlisted personnel in the first year the program was offered to each group. To the extent that eligible personnel may have been surprised by the sudden introduction of the VSI/SSB program and, thus, may have been unable to analyze their military and civilian career opportunities rationally, the effect of a future separation bonus on voluntary separation may substantially differ from the one estimated in this thesis. A study using data on the entire time period during which the VSI/SSB program was offered could shed more light on the effect of the program on the respective groups of eligibles. Data from subsequent years on the voluntary separation behavior of bonus eligibles should be pooled to determine whether the VSI/SSB program was an efficient and effective tool to shape the force to meet future end strength goals. Future manpower planners could use these results to better determine the amount of a financial voluntary separation bonus that should be offered, once the end strength goal is known. Additionally, the resulting estimates could provide a more accurate basis for calculating the total cost and the total economic benefit of the separation bonus program.

One area that needs attention is a comparison of program acceptance behavior between the military Services. If the decision to accept a separation bonus differs inherently between Services, a voluntary separation program that induces sufficient personnel of one Service to leave, may be found to be too

attractive or too unattractive in another Service. Future voluntary separation programs should differ between Services according to their respective drawdown requirements and the Service-specific predictions of the acceptance behavior of a voluntary separation program.

APPENDIX A. ESTIMATES OF THE EXPECTED MILITARY PAY

Appendix A presents the values of the expected military pay by YOS. To estimate the service members' probability of being in a certain paygrade given YOS, the Navy's officer and enlisted master files for FY93 and FY92, respectively, and the Air Force's enlisted master file for FY92 were obtained from the Defense Manpower Data Center (DMDC). Table A.1 illustrates the probability of being in a specific paygrade by YOS for female Navy officers in FY93. These probabilities were then combined with Defense Finance and Accounting Service (DFAS) military pay data of FY92 and FY93 to obtain the expected value of military pay by YOS. Military retirement benefits were estimated as 50 percent of the military base pay at YOS 20. Tables A.2 and A.3 display the values of the expected annual military pay by year of service for female and male officers in FY93. Tables A.4 and A.5 show the respective estimates for Navy enlisted in FY92. Finally, Tables A.6 and A.7 list the expected annual military pay by YOS for female and male Air Force enlisted personnel in FY92.

Table A.1 Probability of Being in a Specific Paygrade by YOS for Female Navy Officers in FY93

YOS	O1	O2	O3	O4	O5	O6
7	2.85	6.00	83.41	7.31	0.42	0.00
8	2.79	4.37	84.85	7.41	0.57	0.00
9	2.64	3.68	80.61	11.88	1.11	0.07
10	3.79	3.18	78.92	12.74	1.14	0.23
11	2.92	4.59	65.72	25.27	1.08	0.42
12	2.29	3.67	47.94	42.9	3.12	0.09
13	3.02	4.03	20.31	64.41	7.78	0.46
14	2.80	2.48	11.66	75.24	6.87	0.96
15	1.84	1.84	11.50	75.54	8.05	1.23
16	1.71	2.22	11.78	66.78	14.69	2.82
17	0.39	1.38	14.26	49.85	32.15	1.97
18	0.39	1.18	15.29	36.99	42.09	4.05
19	0.30	1.79	14.95	34.08	45.59	3.29
20	0.14	0.68	10.27	33.38	52.84	2.70

source: derived from data obtained from DMDC

Table A.2 Expected Military Pay by YOS for Female Navy Officers in FY93

YOS	Exp. Mil. Pay, Single	Exp. Mil. Pay, Married
7	37,296	38,424
8	37,992	39,072
9	38,148	39,228
10	40,056	41,136
11	40,488	41,556
12	43,032	44,124
13	43,956	45,072
14	46,176	47,280
15	46,464	47,556
16	48,528	49,692
17	49,404	50,640
18	51,636	52,944
19	51,708	53,028
Retirement Pay	25,008	25,008

source: calculations by author, derived from data obtained from DMDC and Defense Finance and Accounting Service (DFAS)

Table A.3 Expected Military Pay by YOS for Male Navy Officers in FY93

YOS	Exp. Mil. Pay, Single	Exp. Mil. Pay, Married
7	37,872	38,964
8	38,064	39,144
9	38,172	39,252
10	40,020	41,100
11	40,344	41,436
12	42,456	43,476
13	43,416	44,460
14	45,588	46,836
15	46,152	47,412
16	47,916	49,056
17	48,756	49,920
18	51,432	52,740
19	51,732	53,040
Retirement Pay	24,918	24,918

source: calculations by author, derived from data obtained from DMDC and Defense Finance and Accounting Service (DFAS)

Table A.4 Expected Military Pay by YOS for Female Navy Enlisted Personnel in FY92

YOS	Exp. Mil. Pay, Single	Exp. Mil. Pay, Married
10	19,050	20,372
11	19,385	20,834
12	20,306	21,795
13	20,590	22,108
14	21,562	23,127
15	22,151	23,760
16	23,110	24,743
17	23,584	25,232
18	24,498	26,150
19	24,672	26,318
Retirement Pay	12,404	12,404

source: calculations by author, derived from data obtained from DMDC and Defense Finance and Accounting Service (DFAS)

Table A.5 Expected Military Pay by YOS for Male Navy Enlisted Personnel in FY92

YOS	Exp. Mil. Pay, Single	Exp. Mil. Pay, Married
10	20,049	21,554
11	20,460	22,034
12	21,578	23,186
13	21,848	23,473
14	22,801	24,443
15	23,146	24,800
16	24,021	25,675
17	24,614	26,265
18	25,242	26,887
19	25,572	27,210
Retirement Pay	12,462	12,462

source: calculations by author, derived from data obtained from DMDC and Defense Finance and Accounting Service (DFAS)

Table A.6 Expected Military Pay by YOS for Female Air Force Enlisted Personnel in FY92

YOS	Exp. Mil. Pay, Single	Exp. Mil. Pay, Married
10	19,050	20,372
11	19,385	20,834
12	20,306	21,795
13	20,590	22,108
14	21,562	23,127
15	22,151	23,760
16	23,110	24,743
17	23,584	25,232
18	24,498	26,150
19	24,672	26,318
Retirement Pay	12,056	12,056

source: calculations by author, derived from data obtained from DMDC and Defense Finance and Accounting Service (DFAS)

Table A.7 Expected Military Pay by YOS for Male Air Force Enlisted Personnel in FY92

YOS	Exp. Mil. Pay, Single	Exp. Mil. Pay, Married
10	20,049	21,554
11	20,460	22,034
12	21,578	23,186
13	21,848	23,473
14	22,801	24,443
15	23,146	24,800
16	24,021	25,675
17	24,614	26,265
18	25,242	26,887
19	25,572	27,210
Retirement Pay	12,102	12,102

source: calculations by author, derived from data obtained from DMDC and Defense Finance and Accounting Service (DFAS)

APPENDIX B. CIVILIAN AGE-EARNINGS PROFILES FOR OFFICERS

Appendix B displays the estimated civilian age-earnings profile used in calculating the returns from leaving the military immediately and the expected future earnings after retirement. The age-earnings profiles were estimated using the Public Use Microdata Samples (PUMS) from the 1990 Decennial Census. PUMS are prepared by the Bureau of the Census and contain records representing five percent or one percent of the housing units in the U.S. and the persons in them. Restricting the data set to only veterans reduced the number of observations from the original 866,383 to 51,212. We assumed officers to have a college degree or higher. Equation (B.1) below displays the estimated civilian age-earnings profile for veterans who are officers:

$$\begin{aligned} \ln(EARNS) = & 7.70 + 0.1 * AGE - 0.0009 * AGE^2 + 0.14 * MARRIED \\ & - 0.22 * MILRET + 0.27 * MALE \end{aligned} \quad (B.1)$$

where $\ln(EARNS)$ is the natural logarithm of the individual's civilian income, AGE is a continuous variable for the individual's age, $MALE$ and $MARRIED$ are dummy variables controlling for gender and marital status, and $MILRET$ is a dummy variable coded = 1 if the veteran had 20 or more YOS, coded = 0 if otherwise. Consistent with the findings of Warner and Goldberg (1986), male and married veterans are found to have higher civilian income, while those who stay longer in the military ($MILRET = 1$) earn less than comparable veterans who leave with less than 20 YOS. Since the civilian income data in PUMS are based on the year prior to the census, the official Consumer Price Indices (CPI) for

1989 and 1993 were used to inflate the individual's predicted annual income to 1993 level.

Tables B.1 and B.2 illustrate the expected civilian earnings for female and male officers who left the military with less than 20 YOS. Tables B.3 and B.4 show the respective civilian income figures for officers after retirement.

Table B.1 Estimated Annual Civilian Earnings by Age for Female Officers who Leave the Military before YOS 20, Base Year 1993

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
25	17,560	20,117
26	18,515	21,212
27	19,487	22,325
28	20,472	23,453
29	21,467	24,594
30	22,470	25,742
31	23,476	26,894
32	24,482	28,047
33	25,484	29,195
34	26,478	30,334
35	27,461	31,460
36	28,428	32,568
37	29,375	33,653
38	30,298	34,710
39	31,192	35,735
40	32,054	36,722
41	32,880	37,668

Table B.1 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
42	33,664	38,566
43	34,404	39,414
44	35,095	40,206
45	35,735	40,939
46	36,320	41,609
47	36,846	42,212
48	37,312	42,745
49	37,713	43,206
50	38,050	43,591
51	38,318	43,899
52	38,518	44,127
53	38,648	44,276
54	38,707	44,343
55	38,695	44,329
56	38,611	44,234
57	38,457	44,058
58	38,234	43,802
59	37,942	43,467
60	37,583	43,056
61	37,159	42,571
62	36,673	42,013
63	36,126	41,387
64	35,522	40,695
65	34,864	39,941
66	34,156	39,130

Table B.1 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
67	33,400	38,264
68	32,601	37,349
69	31,763	36,388
70	30,889	35,388
71	29,985	34,351
72	29,053	33,284
73	28,099	32,191
74	27,126	31,076
75	26,139	29,945
76	25,141	28,802
77	24,137	27,652
78	23,131	26,499

source: derived from Public Use Microdata Samples (PUMS) 1990

Table B.2 Estimated Annual Civilian Earnings by Age for Male Officers who Leave the Military before YOS 20, Base Year 1993

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
25	22,952	26,295
26	24,201	27,725
27	25,471	29,180
28	26,759	30,655
29	28,060	32,146
30	29,370	33,647
31	30,685	35,153
32	32,000	36,660
33	33,309	38,160

Table B.2 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
34	34,609	39,649
35	35,894	41,121
36	37,158	42,569
37	38,396	43,987
38	39,602	45,369
39	40,771	46,708
40	41,897	47,999
41	42,976	49,234
42	44,001	50,409
43	44,968	51,517
44	45,872	52,553
45	46,709	53,511
46	47,473	54,386
47	48,161	55,174
48	48,769	55,871
49	49,294	56,473
50	49,734	56,976
51	50,085	57,379
52	50,346	57,678
53	50,516	57,872
54	50,593	57,960
55	50,577	57,942
56	50,468	57,817
57	50,267	57,587
58	49,975	57,252
59	49,593	56,815
60	49,124	56,278

Table B.2 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
61	48,570	55,643
62	47,934	54,914
63	47,219	54,096
64	46,430	53,191
65	45,570	52,206
66	44,644	51,145
67	43,656	50,014
68	42,612	48,817
69	41,516	47,562
70	40,375	46,254
71	39,192	44,900
72	37,975	43,505
73	36,727	42,076

source: derived from Public Use Microdata Samples (PUMS) 1990

Table B.3 Estimated Annual Civilian Earnings by Age for Female Officers
after Retiring from the Military, Base Year 1993

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
25	14,131	16,189
26	14,900	17,070
27	15,682	17,965
28	16,474	18,873
29	17,275	19,791
30	18,082	20,715
31	18,891	21,643
32	19,701	22,570
33	20,507	23,494

Table B.3 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
34	21,308	24,411
35	22,099	25,317
36	22,877	26,208
37	23,639	27,081
38	24,382	27,932
39	25,101	28,757
40	25,795	29,551
41	26,459	30,312
42	27,090	31,035
43	27,686	31,717
44	28,242	32,355
45	28,757	32,945
46	29,227	33,484
47	29,651	33,969
48	30,025	34,398
49	30,349	34,768
50	30,619	35,078
51	30,836	35,326
52	30,996	35,510
53	31,101	35,630
54	31,148	35,684
55	31,138	35,673
56	31,071	35,596
57	30,948	35,454
58	30,768	35,248
59	30,533	34,979
60	30,244	34,648

Table B.3 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
61	29,903	34,257
62	29,511	33,809
63	29,071	33,305
64	28,585	32,748
65	28,056	32,142
66	27,486	31,488
67	26,878	30,792
68	26,235	30,055
69	25,560	29,282
70	24,857	28,477
71	24,129	27,643
72	23,380	26,784
73	22,612	25,905
74	21,829	25,008
75	21,034	24,098
76	20,232	23,178
77	19,424	22,252
78	18,614	21,325

source: derived from Public Use Microdata Samples (PUMS) 1990

Table B.4 Estimated Annual Civilian Earnings by Age for Male Officers
after Retiring from the Military, Base Year 1993

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
36	29,902	34,257
37	30,898	35,398
38	31,868	36,510
39	32,809	37,588
40	33,716	38,626
41	34,584	39,621
42	35,409	40,566
43	36,187	41,458
44	36,915	42,291
45	37,587	43,062
46	38,202	43,766
47	38,756	44,401
48	39,245	44,962
49	39,668	45,446
50	40,022	45,851
51	40,304	46,175
52	40,515	46,415
53	40,651	46,572
54	40,713	46,643
55	40,700	46,628
56	40,613	46,528
57	40,451	46,342
58	40,216	46,073
59	39,909	45,721
60	39,531	45,289
61	39,085	44,778

Table B.4 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
62	38,573	44,191
63	37,998	43,533
64	37,363	42,805
65	36,671	42,012
66	35,926	41,158
67	35,131	40,248
68	34,291	39,285
69	33,409	38,275
70	32,490	37,223
71	31,539	36,132
72	30,559	35,010
73	29,555	33,860

source: derived from Public Use Microdata Samples (PUMS) 1990

APPENDIX C. CIVILIAN AGE-EARNINGS PROFILES FOR ENLISTED PERSONNEL

Appendix C presents the estimates of the annual civilian earning opportunities for Navy and Air Force enlisted personnel. The age-earnings profile for veterans with high school degrees, as estimated using the 1990 PUMS data, is displayed in Equation (C.1) below.

$$\begin{aligned} \ln(EARNS) = & 7.94 + 0.08 * AGE - 0.0008 * AGE^2 + 0.14 * MARRIED \\ & - 0.15 * MILRET + 0.27 * MALE \end{aligned} \quad (C.1)$$

Using the CPI, the individual's predicted annual civilian income by age was then inflated to 1992.

Tables C.1 and C.2 display the expected civilian earnings for female and male enlisted who left the military with less than 20 YOS. Tables C.3 and C.4 show the respective civilian income figures for enlisted after retirement.

Table C.1 Estimated Annual Civilian Earnings by Age for Female Enlisted who Leave the Military before YOS 20, Base Year 1992

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
25	14,326	16,413
26	14,913	17,085
27	15,500	17,757
28	16,085	18,428
29	16,666	19,094
30	17,242	19,753
31	17,810	20,404
32	18,369	21,043
33	18,915	21,670

Table C.1 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
34	19,448	22,280
35	19,965	22,872
36	20,464	23,444
37	20,943	23,992
38	21,400	24,516
39	21,833	25,012
40	22,241	25,479
41	22,621	25,915
42	22,972	26,317
43	23,293	26,685
44	23,581	27,015
45	23,837	27,308
46	24,057	27,561
47	24,243	27,773
48	24,392	27,944
49	24,504	28,073
50	24,579	28,158
51	24,615	28,200
52	24,614	28,199
53	24,575	28,153
54	24,498	28,065
55	24,383	27,934
56	24,231	27,760
57	24,043	27,545
58	23,820	27,289
59	23,563	26,994
60	23,272	26,661

Table C.1 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
61	22,949	26,291
62	22,596	25,886
63	22,213	25,448
64	21,804	24,979
65	21,369	24,481
66	20,910	23,956
67	20,430	23,405
68	19,930	22,832
69	19,412	22,239
70	18,878	21,627
71	18,331	21,000
72	17,772	20,360
73	17,203	19,708
74	16,627	19,048
75	16,045	18,382
76	15,460	17,711
77	14,873	17,039
78	14,286	16,367

source: derived from Public Use Microdata Samples (PUMS) 1990

Table C.2 Estimated Annual Civilian Earnings by Age for Male Enlisted
who Leave the Military before YOS 20, Base Year 1992

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
25	18,726	21,453
26	19,493	22,331
27	20,260	23,210
28	21,024	24,086
29	21,784	24,957
30	22,537	25,819
31	23,279	26,669
32	24,009	27,505
33	24,723	28,324
34	25,420	29,122
35	26,095	29,895
36	26,747	30,643
37	27,373	31,360
38	27,971	32,044
39	28,537	32,693
40	29,070	33,303
41	29,567	33,873
42	30,026	34,399
43	30,445	34,879
44	30,823	35,311
45	31,156	35,693
46	31,445	36,024
47	31,687	36,302
48	31,882	36,525
49	32,029	36,693
50	32,126	36,805

Table C.2 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
51	32,174	36,860
52	32,172	36,858
53	32,121	36,799
54	32,020	36,683
55	31,870	36,511
56	31,672	36,284
57	31,427	36,003
58	31,135	35,669
59	30,798	35,283
60	30,418	34,848
61	29,996	34,364
62	29,534	33,835
63	29,035	33,263
64	28,499	32,650
65	27,931	31,998
66	27,331	31,312
67	26,704	30,592
68	26,050	29,843
69	25,373	29,068
70	24,675	28,268
71	23,959	27,449
72	23,229	26,611
73	22,486	25,760

source: derived from Public Use Microdata Samples (PUMS) 1990

Table C.3 Estimated Annual Civilian Earnings by Age for Female Enlisted
after Retiring from the Military, Base Year 1992

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
25	12,303	14,095
26	12,807	14,672
27	13,311	15,250
28	13,814	15,825
29	14,313	16,397
30	14,807	16,964
31	15,295	17,523
32	15,775	18,072
33	16,244	18,610
34	16,702	19,134
35	17,146	19,642
36	17,574	20,133
37	17,985	20,605
38	18,378	21,054
39	18,750	21,481
40	19,100	21,882
41	19,427	22,256
42	19,728	22,601
43	20,004	22,917
44	20,252	23,201
45	20,471	23,452
46	20,660	23,669
47	20,820	23,852
48	20,948	23,998
49	21,044	24,109
50	21,108	24,182
51	21,140	24,218

Table C.3 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
52	21,138	24,217
53	21,105	24,178
54	21,038	24,102
55	20,940	23,989
56	20,810	23,840
57	20,648	23,655
58	20,457	23,436
59	20,235	23,182
60	19,986	22,896
61	19,708	22,579
62	19,405	22,231
63	19,077	21,855
64	18,725	21,452
65	18,352	21,024
66	17,958	20,573
67	17,545	20,100
68	17,116	19,608
69	16,671	19,098
70	16,212	18,573
71	15,742	18,035
72	15,262	17,485
73	14,774	16,925
74	14,279	16,358
75	13,779	15,786
76	13,277	15,210
77	12,773	14,633
78	12,269	14,056

source: derived from Public Use Microdata Samples (PUMS) 1990

Table C.4 Estimated Annual Civilian Earnings by Age for Male Enlisted
after Retiring from the Military, Base Year 1992

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
25	16,082	18,423
26	16,740	19,178
27	17,399	19,933
28	18,056	20,685
29	18,708	21,433
30	19,355	22,173
31	19,992	22,904
32	20,619	23,621
33	21,232	24,324
34	21,830	25,009
35	22,411	25,674
36	22,971	26,316
37	23,508	26,932
38	24,021	27,519
39	24,508	28,077
40	24,965	28,601
41	25,392	29,090
42	25,786	29,542
43	26,146	29,954
44	26,470	30,325
45	26,757	30,653
46	27,005	30,937
47	27,213	31,176
48	27,380	31,368
49	27,506	31,512
50	27,590	31,608

Table C.4 Continued

Age	Civ. Earnings, Single Personnel (\$)	Civ. Earnings, Married Personnel (\$)
51	27,631	31,655
52	27,630	31,653
53	27,585	31,603
54	27,499	31,503
55	27,370	31,356
56	27,200	31,161
57	26,989	30,919
58	26,738	30,632
59	26,449	30,301
60	26,123	29,927
61	25,760	29,512
62	25,364	29,058
63	24,935	28,566
64	24,475	28,039
65	23,987	27,480
66	23,472	26,890
67	22,933	26,272
68	22,371	25,629
69	21,790	24,963
70	21,191	24,277
71	20,576	23,573
72	19,949	22,854
73	19,310	22,123

source: derived from Public Use Microdata Samples (PUMS) 1990

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